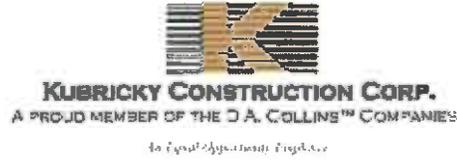


KUBRICKY CONSTRUCTION CORP.
269 BALLARD ROAD

WILTON, NY 12831
518 792-5864



Rutland City BRF 3000 (2014036)
SUBMITTAL 18

Issued 11/26/14
Respond by 12/17/14

Potential Schedule Impact

To
Timothy Pockette, PE

Topic Drilled Shaft Installation Plan
Status For Approval
Spec section 900.640
Sent to approver 11/26/14

From
HARPER T CALLAHAN

Signed by

Date

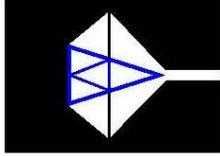
11/26/14

Proceed as Indicated

Date

Owner Authorized Representative

**BUFFALO DRILLING COMPANY
INC.**



10440 MAIN ST.
CLARENCE, NY 14031
PHONE (716)759-7821
FAX (716)759-7823

November 25th, 2014

Attn: Volker Kulbricky
Kubricky Construction Corp.

Project: Replacement of River Street Bridge
North River Street
Rutland, Vermont

Submittal for Drilled Caisson Construction for the Rutland City Bridge

Attachments:

- 0a Rutland City Bridge Pictorial Table of Contents
- 0b Rutland City Bridge Caisson Construction Submittal
- 0c Methods for Checking Shaft Alignment, Plumbness, and Diameter
- 0d NYS DOT Construction Monitoring – Section 7 pages 15-18
- 0e Temporary + Permanent Casing Graphic
- 1a Jinta SD20E Spec Sheet
- 2 MSDS Sheets
- 3 ACI Limits on Free Fall of Concrete
- 4a GSP5-10-20-206 Submersible Pump
- 5 CreteLox Bonding Agent Spec
- 6a Shore PacR Polymer Slurry Drilling Process
- 6b Cetco Design for Rutland River Bridge Caisson
- 6c Shore Pac Disposal
- 7 Jobs, Operators, and Crew
- 8 Temp Casing Cert + Removal Submittals
- 9a 4,000 psi Concrete ~ VT Class SCC
- 9b VT Class SCC Mix Backup Documentation for Concrete Components
- 9c NRMC Self Consolidating Concrete Brochure
- 9d NRMC Self Consolidating Concrete – Concrete in Practice
- 9e Concrete Boom Truck
- 10 GeoVision Down-Hole Camera
- 11a CHA CLS Equipment
- 11b CHA Equipment & CSL Method
- 11c CHA – QXSpecs
- 11d CSL Statement of Qualification
- 12a Buffalo Drilling Concrete Core Retrieval
- 12b Drill Rig 208
- 12c Drill Rig 209
- 12d Drill Rig 213
- 12e Drill Rig 222
- 12f NX Core Barrel System
- 12g Manual Core Machine Stand and M2 Roller Carriage Upgrade
- 12h Core Catcher System

-  0 Submittal for Rutland City Bridge Caisson Construction Cover-Sheet
-  0a Rutland City Bridge Pictorial Submittal Table of Contents
-  0b Rutland City Bridge - Caisson Construction Submittal
-  0c Methods for Checking Shaft Alignment, Plumbness, and Diameter
-  0d NYS DOT Construction Monitoring - Section 7 pages 15-18 rel.2
-  0e Temporary + Permanent Casing Graphic
-  1a Jinta SD20E Spec Sheet
-  2 MSDS Sheets
-  3 ACI Limits on Free Fall of Concrete
-  4a GSP5-10-20-206 Submersible Pump
-  4b GPL-50HX Slurry Pump
-  5 Cretelox Bonding Agent Spec
-  6a Shore PacR Polymer Slurry Drilling Process
-  6b Cetco Design for Rutland River Bridge Caisson
-  6c Shore Pac Disposal
-  7 Jobs, Operators, and Crew
-  8 Temp Casing Cert + Removal Submittals
-  9a Concrete Mix Components ~ VT Class SCC
-  9b VT Class SCC Concrete Submittal
-  9c NRMCC Self Consolidating Concrete Brochure
-  9d NRMCC Self Consolidating Concrete - Concrete in Practice
-  9e Concrete Boom Truck
-  10 GeoVision Down-Hole Camera
-  11a CHA CLS Equipment
-  11b CHA Equipment & CSL Method
-  11c CHA-QXSpecs
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Buffalo Drilling Company, Inc. (BDC) Caisson Construction Submittal for the Rutland City Bridge

Summary: It is the intention of BDC to advance telescoping temporary (144.0 inch diameter) and permanent (120 and 96 inch diameter) casing down to and into the weathered bedrock with the casing bottoming out at elevation 480.32 feet. All references to casing diameters, lengths, top, and tip elevations are depicted on **Attachment 0e Temporary + Permanent Casing Graphic**. The remaining 48.02 feet will be advanced in the open with the distinct possibility of using either water or Cetco polymer slurry to maintain the integrity of the shaft. After the caisson shaft has been inspected and accepted, BDC will assist *Kubricky Construction Corp. (KCC)* with the setting of *KCC's* rebar cage, and will tremie pour BDC's 4,000 psi Self-Consolidating Concrete using a concrete boom truck, both of which will be supplied by *Carrara Concrete*. The pour will pause when the concrete has risen to the top of or just below the top of the 120 inch diameter casing. The top of the concrete will then be cleaned and a permanent 96 inch diameter by 8.0 foot long culvert casing will be placed over the cage and approximately 3.0 feet into the 10.0 foot diameter casing. The pour will then resume with concrete rising to the top of the culvert casing which will match the top of the caisson and the bottom of pier cap, elevation 521.32 feet. The means and methods are detailed below.

A) Progression through Obstructions/ Rock

Buffalo Drilling Company will employ, as needed, rock augers, core barrels, star busters, and temporary casing with or without rock teeth to remove any unanticipated obstructions.

B) Keeping the Hole Open

BDC, working with *KCC*, will first install a 144 inch diameter x 15.0 foot long temporary casing which will be drilled in place to approximately 7.0 feet below the bottom of the river bottom or elevation 511.32. After the casing has been set, it will be stabilized with framing and a deck constructed by *KCC* to allow 360 degree access to the caisson. *BDC*, working with *KCC* surveyors, will mark out offsets dimensions on the top of the 144 inch temporary casing for use in aligning the 120 inch and 96 inch diameter permanent casing during their installation processes.

BDC will then proceed to advance a 120 inch diameter permanent casing to a tip elevation of 498.32 feet. This will be accomplished with the use of augers and core barrels to drill both with and in front of the tip of the permanent casing and drag the casing along with the drill tooling. This method eliminates any void situation between the outside of the casing and the soils. After the 120 inch diameter casing has been set in place, the same procedure would be followed for the setting 96 inch diameter casing to a tip elevation of 480.32 feet.

At this point, the shaft should be able to be advanced in the open into the highly weathered bedrock. If the shaft in the bedrock does not stay open, Buffalo Drilling Company is prepared to use water or Cetco drill slurry (**Attachments 6a, 6b, and 6c**) to maintain the integrity of the shaft to the caisson tip elevation of 432.30 feet.

In some instances, slurry drilling techniques are employed with the sole purpose to maintain hole stability in the overburden long enough to advance a temporary or permanent casing into place. *BDC* does not anticipate employing this method for the setting of the permanent casing because voids between the casing and the soils are created. The permanent casing that *BDC* is setting will be drilled into place to eliminate the creation of said voids.

C) Sequencing of Shaft Construction

KCC will be responsible to locate the center of shaft and specific elevations using registered land surveyors and/or engineers, establish offsets, and monitor locations during construction using tape measures, total stations, and or laser leveling equipment as needed.

There will be only one shaft to be drilled which will be the 96 inch diameter shaft which is located on the edge of Otter Creek just south of the northern branch of East Creek. Upon completion of the specified drilled shaft, BDC will employ the Mini-SID camera system (Attachments 13a and 13b) to view the bottom of the shaft and measure the depth of sediment remaining. After concrete is poured and set *Barron and Associates, P.C.* will perform a Sonic Log Test (**Attachments 11a, 11b, 11c, and 11d**).

The determination of the Bottom of the Caisson (BoC) or the bottom of the shaft will be established by the engineering geologist and would most likely employ a combination of methods. These methods could include, but not be limited to, the measuring the depth of the shaft as well as the examination of the cuttings removed from the shaft. Additional methods can be obtained from the individual who is assigned with the responsibility to inspect the shaft, such as the engineering geologist.

Methodology for installation of shaft could vary based on the length of the overburden to be drilled and sleeved, the consistency of the soils, the use of temporary or permanent casing, and the interaction with boulders or obstructions. Shallow lengths of casing, i.e. less than 15 feet, can be installed by drilling a shallow excavation, two to three feet deep, somewhat smaller than diameter of the casing to be set. At this point an auger can be run down to loosen the soils allowing for the casing to be advanced through crowding and spinning it into the soils with the drill rig. The soils below the shallow excavation would not be removed unless they presented a stand up period that would allow their removal and the installation of a temporary casing without the collapse of the shaft. If the soils will not stand up, the casing would be spun into ground using the drill rig while at the same time using an auger or core barrel to cut the soils as the casing is dragged along with the cutting tool. Soils would then be removed to the bottom of the casing and could be advanced further by incrementally loosening the soils in front of the casing while continuing to spin the casing down until the toe of the casing has reached the desired elevation. This incremental advancement of the casing will avoid the collapsing of the shaft soils while at the same time install the casing without creating any voids between the permanent casing and the surrounding soils. With all sections of the temporary and permanent casing set and soils removed, methods for excavating through the 96 inch diameter highly weathered rock would employ the use of rock augers, core barrels, busters, and carbide tipped rock teeth. Alignment of casing, shafts, and rock sockets will be maintained using offsets, gravity, rig orientation, leveling of rig/Kelly bar, lasers, and total stations.

The construction of this shaft will use permanent and temporary casing of 15 to 20 feet lengths (**0e Temporary + Permanent Casing Graphic**) and will require four sleeves. BDC anticipates a quadruple sleeved shaft using three sections of permanent casing and one temporary section.

BDC will also be prepared to use, if required, slurry drilling methods employing Cetco polymer slurry products (**Attachments 6a, 6b, and 6c**). One of the purposes for the use of

slurry for this would be to maintain shaft stability to allow for the insertion of temporary or permanent casing. . If the shaft, which has casing set into the weathered bedrock, stays open during the uncased drilling process, the slurry, if used, would be pumped back to the holding tank and either reused or disposed of by *KCC*.

The other purpose, would be to maintain hole stability and integrity without the use of casing as the shaft is advanced beyond the tip of the permanent casing to the BoC or Tip Elevation of the caisson. This is where BDC anticipates using either the head pressure of keeping the shaft full of water to maintain uncased shaft integrity or introducing Cetco ‘ShorePac’ Drilling Slurry to enhance the pressure and viscosity even further. Additional Cetco products could and would be employed for de-sanding the slurry, increasing the viscosity to deal with adverse sand or gravel situations, or to breakdown the slurry entirely.

Upon completion of shaft/rock socket construction, viewing with *BDC*’s GeoVision Downhole Camera (**Attachment 10 GeoVision Down-Hole Camera**), inspection by the engineering geologist, *KCC* would deliver to the hole their cage cut to the required length. Before setting, *BDC* will attachment to the rebar cage *KCC*’s booties and centralizers, the cage will be lifted using the winch line on the a crane supplied by *KCC* and be placed in the shaft. Concrete will be placed using freefall, tremie, concrete boom pump, or hopper with elephant trunk all dependent on the water conditions encountered. It is highly likely that we will be employing the boom pump truck on this project. The above pour techniques are discussed further in Item J.

D) Type of Equipment

The drill rig used will be Jinta SD-20E (Attachment 1a). Anticipated drill tooling is listed at the conclusion of this submittal under item Q.

BDC will supply and operate a down-hole camera system (**Attachment 10 GeoVision Down-Hole Camera**), to allow for black and white viewing of the bottom and sides of the shaft.

Barron & Associates, P.C. will provide for the sonic log tests using the Pile Dynamics CHA equipment (**Attachment 11a, 11b, 11c, and 11d**) . They will be working with *GRL Engineers, Inc.* in the analysis of the results and preparation of the report.

E) Cleaning Shafts and Soil Disposal

Buffalo Drilling Company will machine clean shaft bottoms using augers, muck buckets, and/or pac man as needed. Soil and slurry disposal will be handled by *KCC*.

F) Documentation – Contractor, Driller, Foreman

BDC will be employing Don Morris who will act as lead driller and foremen while the BDC crew is on site.(**Attachment # 7 Jobs, Operators, and Crew**) The operator could change based on his availability at the time construction begins.

G) Shaft Excavation Methods and Final Shaft Dimensions

Buffalo Drilling Company proposes to use temporary and permanent sleeves to construct the shaft, with one temporary and two permanent casings, into the weathered bedrock. At this point, the shaft will be further advanced without the use of a casing. The final abutment shaft dimensions will be dependent on the soil conditions but BDC is planning on using 144 inch diameter upper temporary casing for the overburden and will be using nominal 120 and 96 inch diameter casing, core barrels, and rock augers to set the permanent casing and a selection of rock augers and core barrels to advance the open shaft to final depth. The previously defined temporary casing dimensions could vary by up to six inches in diameter depending on the soil and rock conditions encountered and the number of casings employed.

- H) The use of slurry is not presently anticipated but if and when it is employed it will be to maintain the shaft integrity below the tip of permanent casing at elevation 480.32 ~ NO slurry will be employed to keep the shaft open during the installation of the three sections of permanent casing. BDC will be using the Cetco line of polymer products (**Attachments 6a, 6b, and 6c**) as needed for the setting of temporary casing or for the maintenance of the shaft integrity below the permanent casing.

I) Reinforcement Placement

Upon completion of shaft construction, *KCC* will move the cage to the shaft. Centralizers and Bar Boots, provided by *KCC*, will be attached to the cage and the cage will be placed in the shaft using a crane, or other lifting equipment supplied by *KCC*. (Boots will be attached to every other vertical while centralizers, horizontally spaced at a maximum of 9.8 feet intervals (3 meters) and placed in symmetric groups of three and four around the cage clipped to the horizontal rebar hoops.)

J) Concrete Placement

Concrete, VT Class SCC, provided by BDC and supplied by Carrara Concrete (**Attachments 9a, 9b, 9c, and 9d**), will be placed in the dry employing free fall methods avoiding hitting sides of shaft or rebar. A hopper and elephant trunk may be employed.

If water is encountered a submersible pump would be lowered to the bottom of the shaft to remove the water to an acceptable level of 2 inches (50 mm) or less. If water infiltration is greater than the capacity of the pump to remove it the pump would be removed and the water would be allowed to fill the hole and rise to a static level. Procedures for either pumping or tremie pour would then be employed to fill the excavation.

- J-1) Pumping concrete employs either a trailer mounted or truck mounted (boom truck) mechanical pumping system. Methods require the lowering to the bottom of the shaft a four or five inch diameter steel pipe. Concrete is then pumped into the excavation. Care must be taken when raising the steel pipe to be sure that the bottom of the steel pipe remains embedded three to five feet into the concrete thus avoiding intermixing the pumped concrete with the water or slurry in the shaft. After the concrete has risen to the level where a five foot head of concrete is apparent in the temporary sleeve the pumping pipe can be removed, pumped off, and any contaminants can be mucked off the top of the concrete and pouring can continue using freefall or hopper with elephant trunk methods.

- J-2) Tremie pouring follows the same procedures as defined when pumping concrete. A tremie pipe, 10 to 12 inch diameter steel or plastic pipe, replaces the 4 to 5 inch diameter pipe used when pumping concrete (J-2). Procedures of plugging, lowering, rising of the tremie relative to embedment and head in the temporary sleeve are the same as outlined above. A hopper is usually used on the top of the tremie pipe to avoid spillage.

For removal of temporary casing see the attachment number 8.

Concrete will be mixed with heated aggregate and hot water, as needed, to satisfy concrete winter conditions. At the completion of the concrete pour the top of the shaft & the extended rebar will be capped and wrapped with insulated blankets supplied by KCC.

K) Concrete Mix and Modified Tremie Mix

The Carrara Concrete company will be providing the concrete for the caisson and has provided BDC with VT Class SCC. The specified mix (**Attachment 9b VT Class SCC Mix #???** **Concrete Submittal**) which will be poured using a concrete boom truck to tremie pour the concrete.

L) Emergency Joint Procedure

Rough up the top of the pour and insert 4 No. 5 dowels 6 foot long, 3 feet into poured concrete. When pour is continued, clean the top of the pier and cover with bonding agent according to the printed direction of bonding agent used. If the joint is too far down the shaft to reach, BDC will employ longer dowels that will extend up the shaft to allow for manual installation. The imbedded length (bottom 3 feet) would be brushed with bonding agent before inserting in the poured concrete. These dowels would be tied off using tie wire to position them properly before concrete pouring resumed.

O) Bonding Agent

ChemMasters bonding agent Cretelox, or a compound approved by the Port Authority will be used as needed per the directions on the attached product data sheet. In order to maintain the moisture of the bonding agent it would only be applied to the rebar and the concrete when we knew that the delivery of the concrete would fall within the required time frame. A brush / roller extension would be used for areas that are out of reach from the top of the shaft. See attachment number 5.

P) Equipment for Inspections

Addressed in Item D – no further information available due to lack of input from Geologist/Geotechnical Engineer.

Q) Equipment and Tooling List

Drill Rigs

2009 Jinta SD-20E

20k Mud Tanks Supplied By Baker Tank

Drill Tools	Diameter
Rock Auger	48", 60", 72", 96", 120" & 144"
Core Barrels	48", 60", 72", 96", & 120"
Muck Bucket	60" & 90"
Star Buster	
Casing	144", 120", & 96" (Varying Lengths)

R) Attachments

- 0c Methods for Checking Shaft Alignment, Plumbness, and Diameter
- 0d NYS DOT Construction Monitoring – Section 7 pages 15-18 rel.2
- 0e Temporary + Permanent Casing Graphic
- 1a Jinta SD20E Spec Sheet
- 2 MSDS Sheets
- 3 ACI Limits on Free Fall of Concrete
- 4a GSP5-10-20-206 Submersible Pump
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- 9a 4,000 psi Concrete ~ VT Class SCC
- 9b VT Class SCC Mix #??? Concrete
- 9c NRMC Self Consolidating Concrete Brochure
- 9d NRMC Self Consolidating Concrete – Concrete in Practice
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0d Methods for Checking Shaft Alignment, Plumbness, and Diameter

Numerous tools are used for assuring the alignment, plumbness and diameter of the drilled shaft. These can range from as simple as a pre-measured stick or bar to computerized and controlled GPS locating device. Buffalo Drilling Company, Inc (BDC) in conjunction with *Kubricky Construction Corp.* (KCC) will follow some of the following protocol to assure that the drilled shaft remains within specified tolerances.

A) Layout of Center of Shaft, Elevations, and Depth/Alignment Review During Shaft Construction

Layout of center of shafts with offsets and benchmark elevations will be provided by the owner, general contractor, or BDC, if contractually obligated, using any number of the following methods: registered surveyor, one stations, GPS system, transits, string lines, tape measures, and laser levels.

Before drilling, BDC will review plans with GC to verify the selected drill location, use our laser leveling system to establish existing elevation and calculate depth required to reach the BoC, set up on the first shaft by centering the drill bit over the hub or staked center of the shaft, check offsets established by others or set our own offsets, mark the distance to shaft on the drill table and/or use the caisson rigs computer control location system, check the level on the rig Kelly bar using levels and/or using the leveling system in the computer console of the drill rig, then begin drilling the shaft.

After the hole has been advanced its initial distance of a couple of feet, the hole center can be checked quickly using the established offsets to verify that the center and edges of the shaft fall within the required location parameters. A weighted tape can be used by lowering it down the shaft and checking depths as the shafts is advanced. These alignment and elevation review processes will be repeated, as needed, until the shaft has reached the BoC elevation.

B) Checking Shaft Diameter and Plumbness

Shaft Diameter can be established by the measurement of the tooling used to cut the shaft, the outside diameter of any temporary or permanent casing used during construction of the shaft, or by using a defined length cross adaptor attached to the Kelly bar and lowered down the shaft.

There are numerous methods for checking the plumbness of shaft construction beginning with the use of levels, plumb Bobs, and/or the leveling system in the drill rig's computer console to level the Kelly bar and then make a visual review as the bar is tabled close to the edge of the shaft. Variations in distance of the bar from the edge of the shaft will ascertain if there is any major deviation from the vertical specification requirements. When installing either temporary or permanent casing, the plumbness of the shaft can be checked by placing a three foot level on the inside of the shaft in the perpendicular or by checking the level across the top of a straight cut of casing. More accurate measurements can be made through the use of a plumb Bob and a bit of geometry, as depicted on pages 2 and 3 of the attached 0e NYS DOT Construction Monitoring guidelines.

C) Measurement of Top and Volume of Concrete

Pages 4 of the attached 0e NYS DOT Construction Monitoring guidelines depicts the float method for checking the top level of the poured concrete and page 5 offers a chart that quantifies the volume of concrete per linear foot based on the diameter of the shaft. These concrete volumes are also calculated by the drill crews using slide calculators that are provided by many concrete suppliers.

D) Shaft Monitoring Tools that May be Employed

Levels – 1.0, 2.0, and/or 4.0'

Plum Bobs

Tape Measures

Weighted Tapes

Float Tape

Slide Concrete Calculators

Laser Level

Offset Sticks

Stakes

Calculator

7. CONSTRUCTION MONITORING

7.1 Monitoring Aids

The next four pages provide the following drilled shaft construction monitoring aids:

- 1) Suggested Method to Check Shaft Plumbness if Horizontal Tolerance is Known - describes a quick procedure to determine if the shaft is out of “plumb” (required verticality). As specified in the specification the allowable tolerance from the required verticality is 2% for vertical shafts, 3% for battered shafts. This procedure assumes that the actual tolerance for the shaft has been computed, based on the allowable tolerance from the required verticality (either 2% or 3%) and the total shaft length. This test should be performed when the shaft excavation is completed.
- 2) Suggested Method to Check Shaft Plumbness - describes a procedure to determine a shaft’s plumbness at any point during construction. It is essentially the same procedure as above. The figure shows three measurements for each check. Keep in mind that if the casing is continuous (i.e. one piece) or no casing is used, only one measurement is required for a plumbness check. This procedure should be performed periodically as the shaft is progressed to maintain correct shaft verticality.
- 3) Suggested Method to Check Concrete Level - describes a procedure to determine the concrete level during pouring. Determining the correct concrete level during the pour is essential for the completion of the concrete curve (a key part of the inspection forms). Basically a tape measure with its end attached to something that will sink in water and other drilling fluids, but will float on the wet concrete is used for this procedure. This will allow the inspector to determine the level of concrete in the shaft at any point during the pour, even if the shaft is filled with water or drilling fluid.
- 4) Shaft Areas and Volumes Table - Is a self explanatory table that aids the inspector in determining the shaft’s volume.

Suggested Method to Check Shaft Plumbness if Horizontal Tolerance is Known

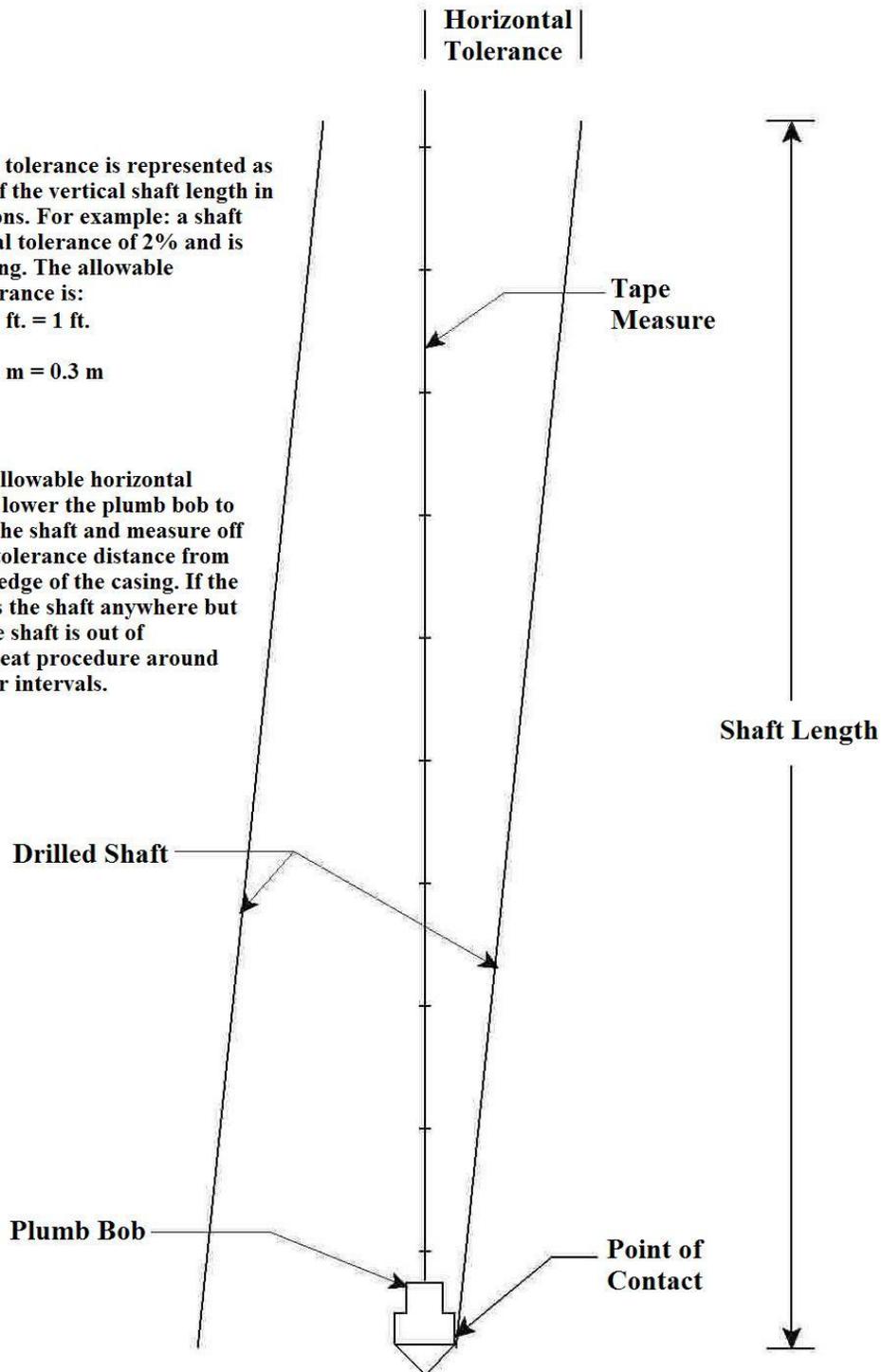
The horizontal tolerance is represented as a percentage of the vertical shaft length in the specifications. For example: a shaft has a horizontal tolerance of 2% and is 50 ft. (15 m) long. The allowable horizontal tolerance is:

$$0.02 \times 50 \text{ ft.} = 1 \text{ ft.}$$

or

$$0.02 \times 15 \text{ m} = 0.3 \text{ m}$$

Knowing the allowable horizontal tolerance, you lower the plumb bob to the bottom of the shaft and measure off the allowable tolerance distance from the line to the edge of the casing. If the plumb bob hits the shaft anywhere but the bottom, the shaft is out of tolerance. Repeat procedure around shaft at regular intervals.



Suggested Method to Check Shaft Plumbness

$$\tan \Phi_1 = X_1 / Y_1$$

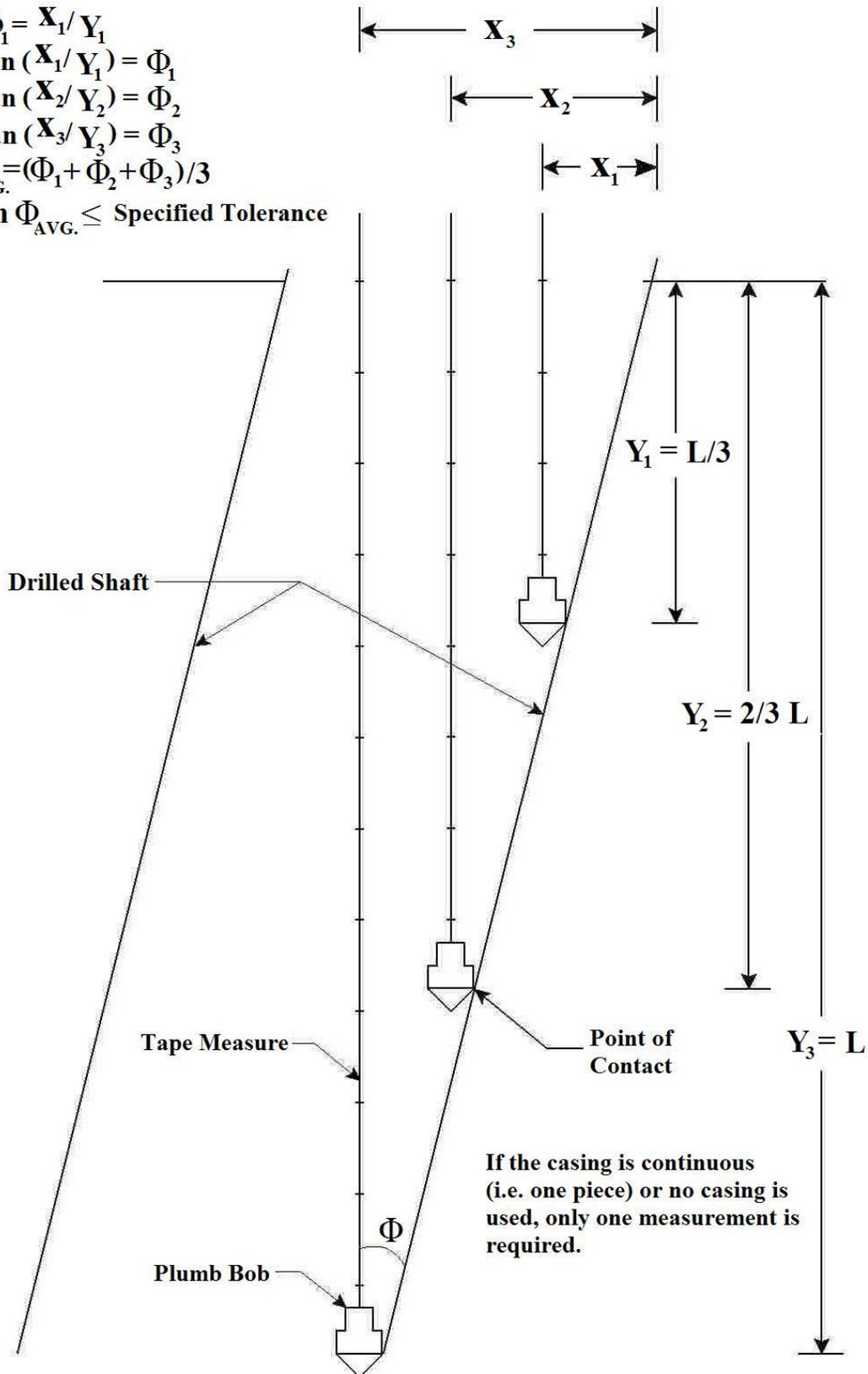
$$\arctan (X_1 / Y_1) = \Phi_1$$

$$\arctan (X_2 / Y_2) = \Phi_2$$

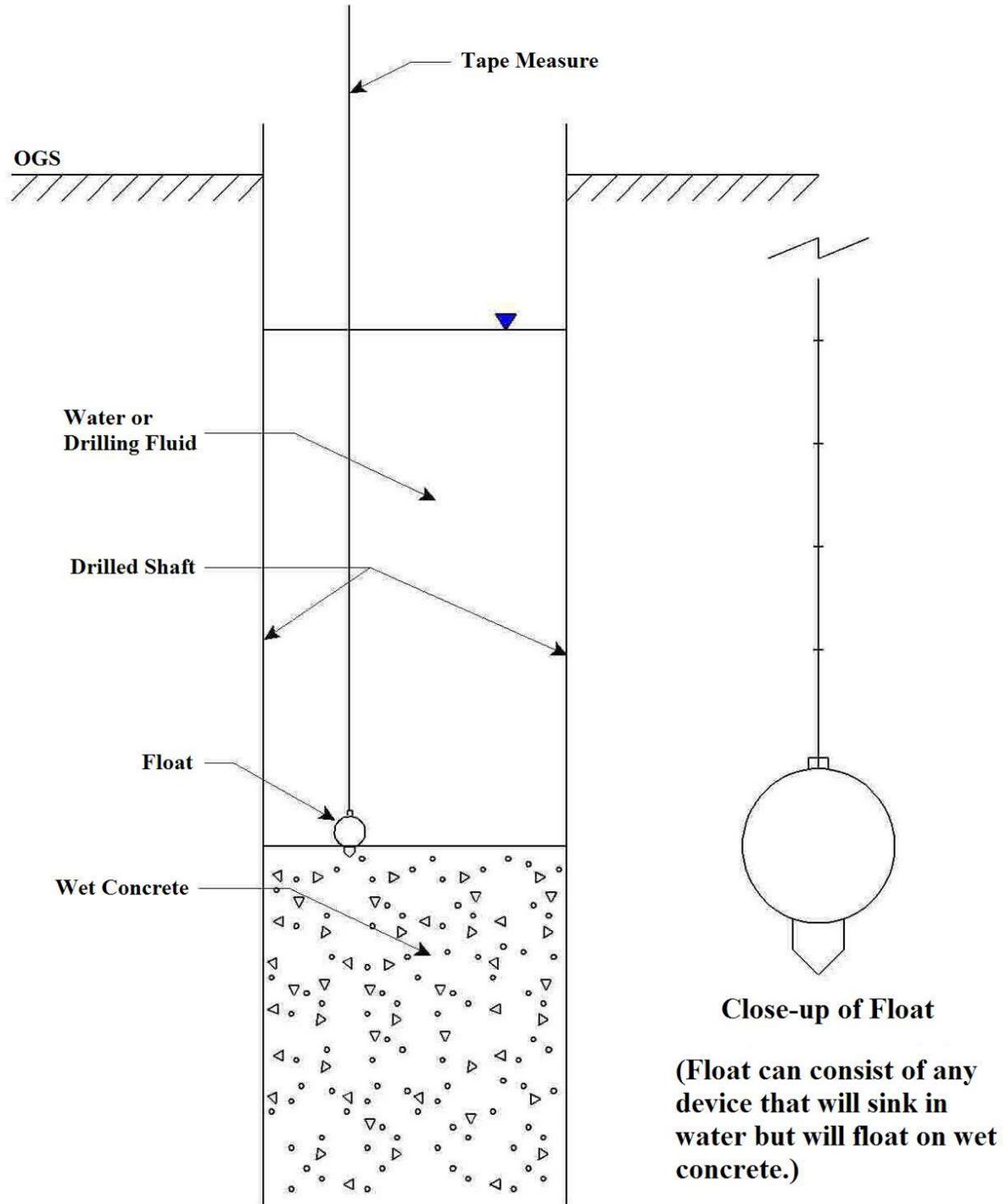
$$\arctan (X_3 / Y_3) = \Phi_3$$

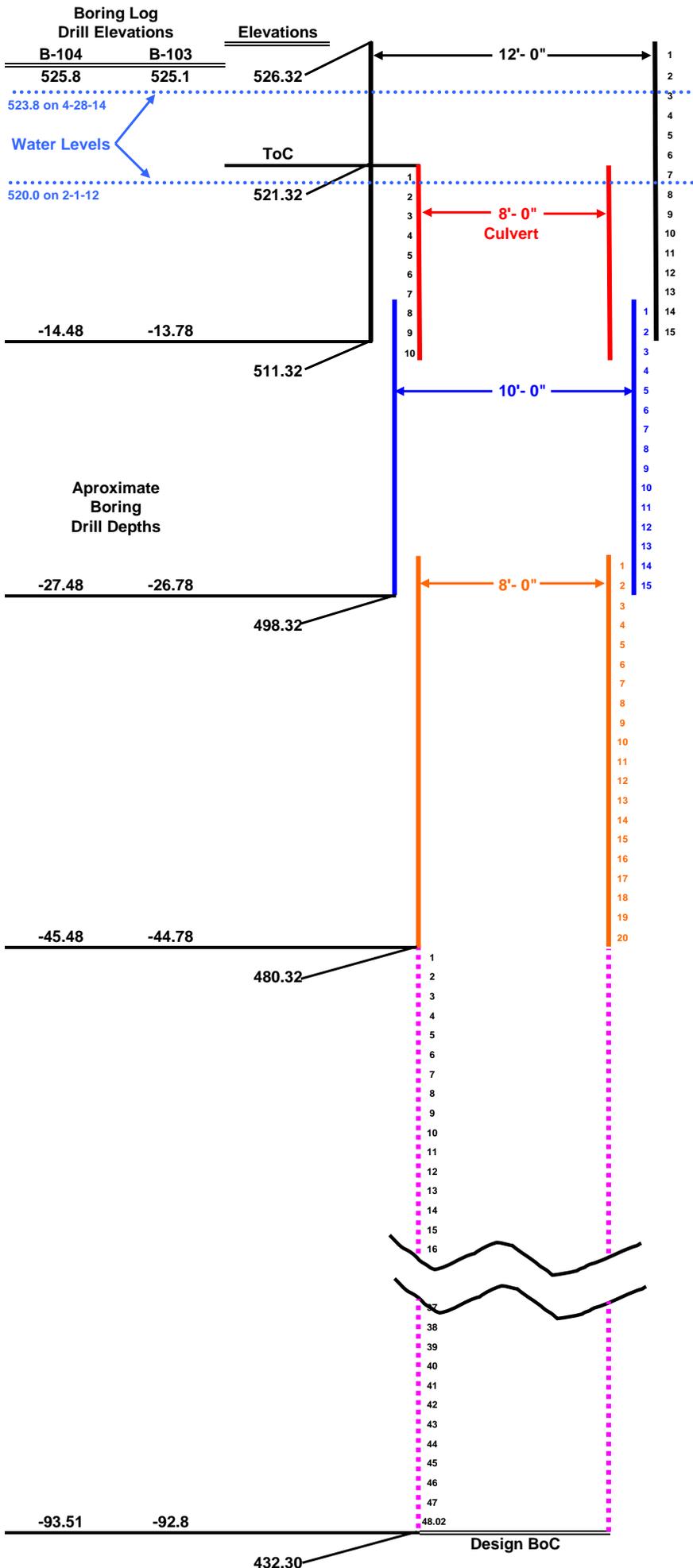
$$\Phi_{AVG.} = (\Phi_1 + \Phi_2 + \Phi_3) / 3$$

$$L \tan \Phi_{AVG.} \leq \text{Specified Tolerance}$$



Suggested Method to Check Concrete Level





- Temporary 12.0' Diameter Casing*
- Permanent 10.0' Diameter Casing*
- Permanent 8.0' Diameter Casing*
- 96" Diameter Open Hole Integrity Maintained Using Water or Slurry
- Permanent 8.0' Culvert Pipe*

*All pipe lengths are approximate and may be a couple of feet longer or shorter than specified. The 10 foot diameter may be substituted for a 9 foot diameter casing and it may be only a temporary casing.

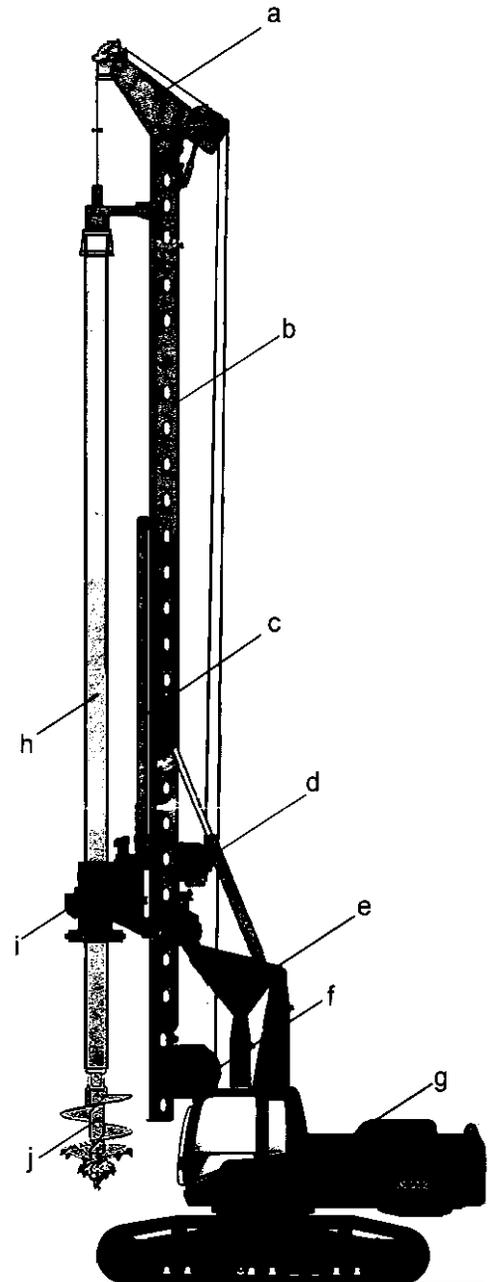
	SD20E Metric	SD20E Imperial
Mast height	19.8m	65.0ft
Operating weight (Approx) c/w Kelly bar	59ton	130,000lb
Rotary head	KDK200	KDK200
Torque at 300 bar (nominal)	200kNm	147,500lb-ft
Speed of rotation	8-30rpm	8-30rpm
Crowd system		
Crowd force push / pull (effective)	160/200kN	35,970/ 44,960lbf
Stroke (kelly system)	5.7m	18.7ft
Stroke (CFA system)	-	-
Speed (down / up)	5 / 6.5m/min	16.4-21.3ft/min
Fast speed (down / up)	-	-
Main winch		
Line pull (1st layer)	180kN	40,470lbf
Rope diameter / Length	26mm / 90m	1.02inch / 263ft
Max. line speed	60m/min	197ft/min
Auxilliary winch		
Line pull (1st layer)	75kN	16,860lbf
Rope diameter / Length	18mm / 60m	0.7inch / 164ft
Max. line speed	45m/min	147.6ft/min
Mast Inclination		
Backward / forward / lateral	15° / 5° / 4.5°	15° / 5° / 4.5°
Max. drilling diameter (uncased)	2000mm	78.7inch
Max. drilling diameter (cased)	1500mm	59.1inch

Main Feature of SD20E

- 1) Sheave Cathead use high-tensile steel and rigid for all kind of drilling purpose
- 2) Box type with interior reinforced rib to provide anti-twist form rotary head.
- 3) Parallelogram mast support provide adjustment for the working radius and always maintain the mast in vertical position.
- 4) Main winch are consisted with Rexroth motor and reduction gear box which can provide high line pull and reliable performance
- 5) Base machine is Caterpillar C325D c/w CAT C-7 diesel engine. Sound proof cabin with air-condition and advance monitoring system
- 6) Undercarriage with extendable track from 3.2 to 4.3m. Main components is impoted from Japan and traction gear from Italy.
- 7) Rotary head can provide power and stable torque. Hydraulic motor is Rexroth and reduction gear box is Brevini
- 8) Special design kelly bar with double kelly guide track to provide rigid and long life using.

Main Components

- a. Mast head
- b. Mast
- c. Crowd cylinder
- d. Auxiliary winch
- e. Mast support
- f. Main winch
- g. Base carrier
- h. Kelly bar
- i. Rotary head
- j. Drilling tools



The multi-purposed hydraulic drilling rig SD20E is specially designed for suiting the following application

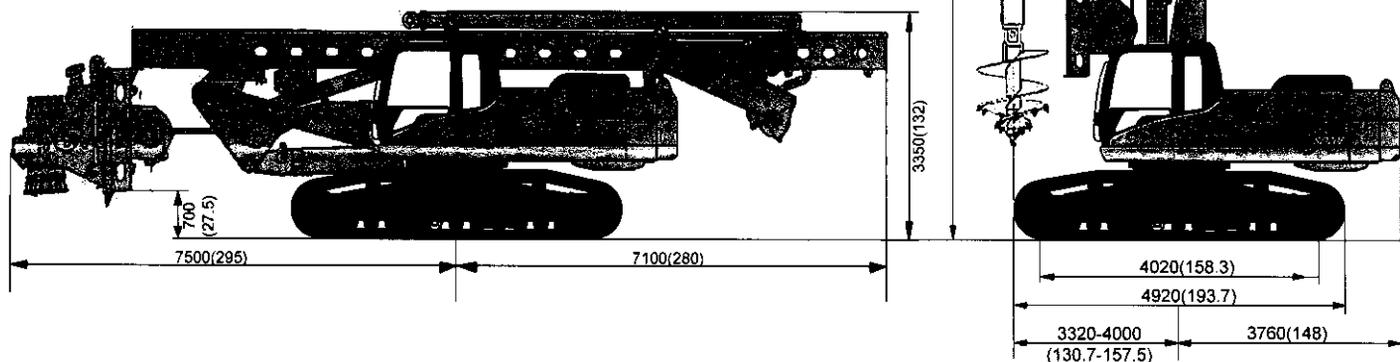
- Large diameter cased bore piles with Kelly Bar
- Air actuated DTH hammer drilling
- Reverse Circulation Drilling (RCD)

The main features of SD20E included:

- 50ton class machine
- High torque KDK200 rotary head
- Powerful Caterpillar C-7 diesel engine
- Advance hydraulic system
- Advance PLC monitoring and control system
- Retractable undercarriage
- Self-erection parallelogram mast support system
- High line pull main winch

Option feature included:

- Crowd winch load indicator
- Casing drive adaptor
- Kelly bar
- Drilling tools



MSDS:

Section I: BOC Gases

Argon: Pages 1 – 6 of 6

Oxygen: Pages 1 – 7 of 7

Argoshield Gas #2C, #5C, #8C, #10C, #15C, #17C, #20C, #25C, and #30C: Pages 1 – 6 of 6

Section II: HPG BMS/BTU

Propylene: Pages 1 – 3 of 3

Section III: Texas Refinery Corp.

#880 Crown & Chassis Grease: 8455/8456

Multi-Lube XKE: 6330

Seal Saver Plus: 6645

#890 Vari-Purpose Gear Lubricant, SAE 85W/140: 8447

#880 Crown & Chassis Aerosol: 8458

DZL-PEP Arctic with AAT: 6375

#890 Vari-Purpose Gear Lubricant SAE 80W/90: 8443

Section IV: Niagara Lubricant

~~**Niagara R&O AW 32 Hydraulic Oil:** Pages 1 – 3~~ replaced w/ Bio-Ultimax

Five Star Ultra TAC MOLY #2, #3: Pages 1 – 3

Five Star Multi- Gear GL5 85W140: Pages 1 – 3

Section V: Renewable Lubricants, Inc.

3A-Bio-Ultimax 1000-2000 Hydraulic Oil: Pages 1 – 4 of 4

Section VI: Noco Energy Corp.

#2 Diesel Fuel LS Clear: Pages 1 – 3 of 3

Low Odor Clear Kerosene: Pages 1 – 5 of 5

Regular Unleaded Gasoline: Pages 1 – 9 of 9

Material Safety Data Sheet

#2 DIESEL FUEL LS

Material Identification and Use

MANUFACTURER'S NAME..... Noco Energy Corp.
MANUFACTURERS ADDRESS..... P.O. Box 86 Tonawanda, New York 14150
EMERGENCY NUMBER..... 1-800-424-9300 (CHEMTREC)
SUPPLIER'S ADDRESS..... Box 86, Tonawanda, New York 14151
SUPPLIER EMERGENCY PHONE NUMBER..... 1-800-500-6626
PRODUCT NAME..... #2 Diesel LS Clear
PRODUCT CODE..... NDIESEL01
CHEMICAL NAME AND SYNONYM..... Middle distillate; Fuel oil
PRODUCT USE..... Fuel Oil

Ingredients

Components	%	CAS Number	Hazard Data
A distillate having minimum viscosity of 32.6 SUS @ 100°F to a maximum of 40.1 SUS @ 100°F	99.9 - 100	68476-34-6	None established

WHMIS CLASSIFICATION.....

Physical Data

PHYSICAL STATE..... Liquid
ODOUR AND APPEARANCE..... Clear liquid with a hydrocarbon odor
SPECIFIC GRAVITY..... 0.84 - 0.88 @ 60°F
VAPOUR PRESSURE (MM HG @ 20°C)..... 0.40 MM HG @ 68°F
VAPOUR DENSITY (air=1)..... 4.7
EVAPORATION RATE..... (Water = 1) Slower
BOILING POINT..... 160°C (320°F)
FREEZING POINT..... Not determined
pH..... Neutral
SOLUBILITY IN H2O (water)..... Negligible

Fire and Explosion Hazards

CONDITIONS OF FLAMMABILITY..... Caution! Combustible liquid & vapor.
EXTINGUISHING MEDIA..... Use water spray, dry chemical, foam or carbon dioxide to extinguish fire.
Use water spray to cool fire-exposed containers, structures and to protect personnel.
FLASHPOINT & METHOD OF DETERMINATION..... 51.70°C (125°F)
UPPER EXPLOSION LIMIT (% BY VOL.)..... 5.0
LOWER EXPLOSION LIMIT (% BY VOL.)..... 0.7
NFPA - HAZARD CLASS..... Fire: 2 Health: 0 Reactivity: 0
HAZARDOUS COMBUSTION PRODUCTS..... Open flames, sparks
UNUSUAL FIRE AND EXPLOSION HAZARD..... Irritating or toxic substances may be emitted upon thermal decomposition. Dangerous when exposed to heat or flame.
SPECIAL FIRE FIGHTING PROCEDURES..... If leak or spill has not ignited, ventilate area and use water spray to disperse gas or vapor and to protect personnel attempting to stop leak. Use water to flush spills away from source of ignition. Do not flush down public sewers.

Material Safety Data Sheet

#2 DIESEL FUEL LS

Reactivity Data

CHEMICAL STABILITY.....	Stable
INCOMPATIBLE MATERIALS.....	Avoid contact with strong oxidizers.
HAZARDOUS DECOMPOSITION.....	Combustion may produce CO, CO ₂ and reactive hydrocarbons.
HAZARDOUS POLYMERIZATION.....	No data

Health Hazard Information

ROUTES OF ENTRY	
SKIN CONTACT.....	Moderately irritating. Repeated or prolonged contact may result in defatting, redness, itching, inflammation, cracking and possible secondary infection.
EYE.....	Slightly irritating. Exposure to vapors, fumes or mists may cause irritation.
INHALATION.....	May cause respiratory tract irritation. Exposure may cause central nervous system symptoms similar to those listed under ingestion.
INGESTION.....	Moderately toxic. Aspiration into lungs may cause pneumonitis. May cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.
CARCINOGENICITY.....	Products of similar composition have produced skin cancer in laboratory animals and have been positive in mutagenic test systems.

Emergency And First Aid Procedures

EYES.....	Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Get medical attention if irritation persists.
SKIN.....	Remove contaminated clothing immediately. Wash area of contact thoroughly with soap and water. Get medical attention if irritation persists. High-pressure skin injections are serious medical emergencies.
INHALATION.....	Remove affected person from source of exposure. If not breathing, ensure open airway and institute CPR. If breathing is difficult, administer oxygen if available. Get medical attention.
INGESTION.....	<u>Do Not Induce Vomiting</u> because of danger of aspirating liquid into lungs. Get immediate medical attention. If spontaneous vomiting occurs, monitor for breathing difficulty.

Preventive Measures

VENTILATION REQUIREMENTS.....	Positive pressure ventilation may be necessary.
RESPIRATORY PROTECTION.....	NIOSH/MSHA approved breathing equipment must be available for non-routine and emergency use. Ventilation may be used to control or reduce airborne concentrations.
EYE PROTECTION.....	Wear safety glasses or chemical goggles to prevent eye contact. Do not wear contact lenses when working with this substance. Have eye washing facilities readily available where eye contact can occur.
PROTECTIVE GLOVES.....	Nitrile, Neoprene
PERSONAL HYGIENE.....	Wash hands thoroughly after handling.
NOTE.....	No data

Material Safety Data Sheet

#2 DIESEL FUEL LS

Environmental Procedures

SPILLS OR RELEASES.....	No flares, smoking or flames in hazard area. Stop leak if you can do it without risk. <u>Small Spills:</u> Take up with sand or other non-combustible absorbent material.
DISPOSAL.....	<u>Large Spills:</u> Dike far ahead of spill for later disposal. This substance, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however, it could be hazardous if it is considered toxic, corrosive, ignitable or reactive according to Federal definitions.
STORAGE.....	Store in tightly closed containers in cool, dry isolated, well-ventilated area away from heat, sources of ignition and incompatibles.

Regulatory Information

DEPT. OF TRANSPORTATION.....	Combustible liquid
TSCA.....	No data
CERCLA.....	No data
RCRA.....	No data
SARA TITLE III - SECTION 302.....	No data
SECTION 311/313.....	No data
SECTION 313.....	No data

Preparation Date of Material Safety Data Sheet

PREPARED BY.....	NOCO - SK
PHONE NUMBER OF PREPARER.....	1-315-393-4530
DATE PREPARED.....	11/25/93
REVISED DATE.....	02/05/98

DISCLAIMER..... Information presented herein has been compiled from information provided to us by our suppliers and other sources considered to be dependable and is accurate and reliable to the best of our knowledge and belief but is not guaranteed to be so. Nothing herein is to be construed as recommending any practice or the use of any product in violation of any patent or in violation of any law or regulation. It is the users' responsibility to determine the suitability of any material for a specific purpose and to adopt such precautions as may be necessary. We make no warranty as to the results to be obtained by using any material and since conditions of use are not under our control, we must necessarily disclaim all liability with respect to the use of any material supplied by us.

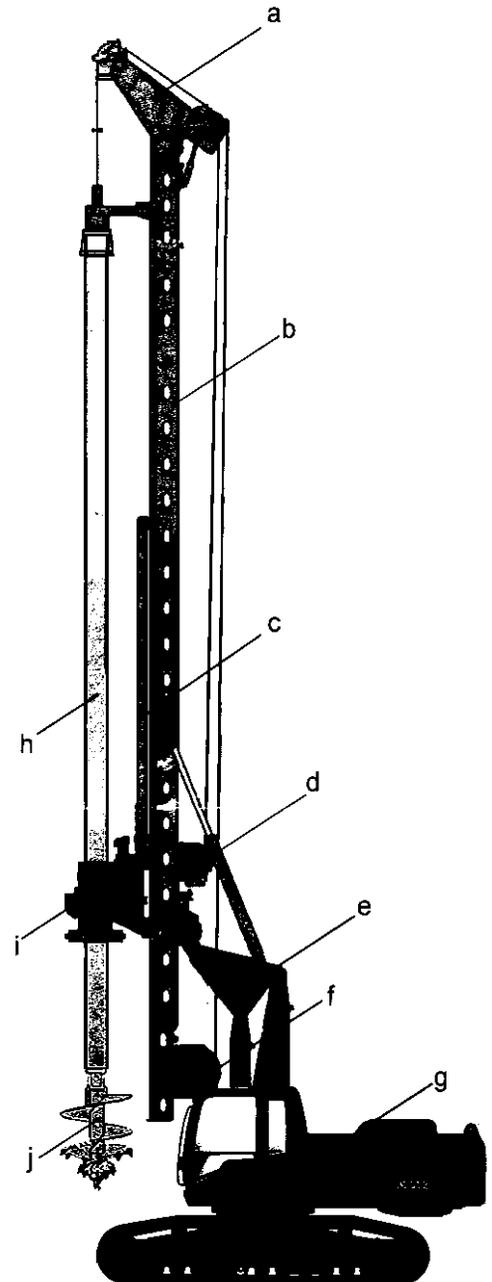
	SD20E Metric	SD20E Imperial
Mast height	19.8m	65.0ft
Operating weight (Approx) c/w Kelly bar	59ton	130,000lb
Rotary head	KDK200	KDK200
Torque at 300 bar (nominal)	200kNm	147,500lb-ft
Speed of rotation	8-30rpm	8-30rpm
Crowd system		
Crowd force push / pull (effective)	160/200kN	35,970/ 44,960lb
Stroke (kelly system)	5.7m	18.7ft
Stroke (CFA system)	-	-
Speed (down / up)	5 / 6.5m/min	16.4-21.3ft/min
Fast speed (down / up)	-	-
Main winch		
Line pull (1st layer)	180kN	40,470lb
Rope diameter / Length	26mm / 90m	1.02inch / 263ft
Max. line speed	60m/min	197ft/min
Auxilliary winch		
Line pull (1st layer)	75kN	16,860lb
Rope diameter / Length	18mm / 60m	0.7inch / 164ft
Max. line speed	45m/min	147.6ft/min
Mast Inclination		
Backward / forward / lateral	15° / 5° / 4.5°	15° / 5° / 4.5°
Max. drilling diameter (uncased)	2000mm	78.7inch
Max. drilling diameter (cased)	1500mm	59.1inch

Main Feature of SD20E

- 1) Sheave Cathead use high-tensile steel and rigid for all kind of drilling purpose
- 2) Box type with interior reinforced rib to provide anti-twist form rotary head.
- 3) Parallelogram mast support provide adjustment for the working radius and always maintain the mast in vertical position.
- 4) Main winch are consisted with Rexroth motor and reduction gear box which can provide high line pull and reliable performance
- 5) Base machine is Caterpillar C325D c/w CAT C-7 diesel engine. Sound proof cabin with air-condition and advance monitoring system
- 6) Undercarriage with extendable track from 3.2 to 4.3m. Main components is impoted from Japan and traction gear from Italy.
- 7) Rotary head can provide power and stable torque. Hydraulic motor is Rexroth and reduction gear box is Brevini
- 8) Special design kelly bar with double kelly guide track to provide rigid and long life using.

Main Components

- a. Mast head
- b. Mast
- c. Crowd cylinder
- d. Auxiliary winch
- e. Mast support
- f. Main winch
- g. Base carrier
- h. Kelly bar
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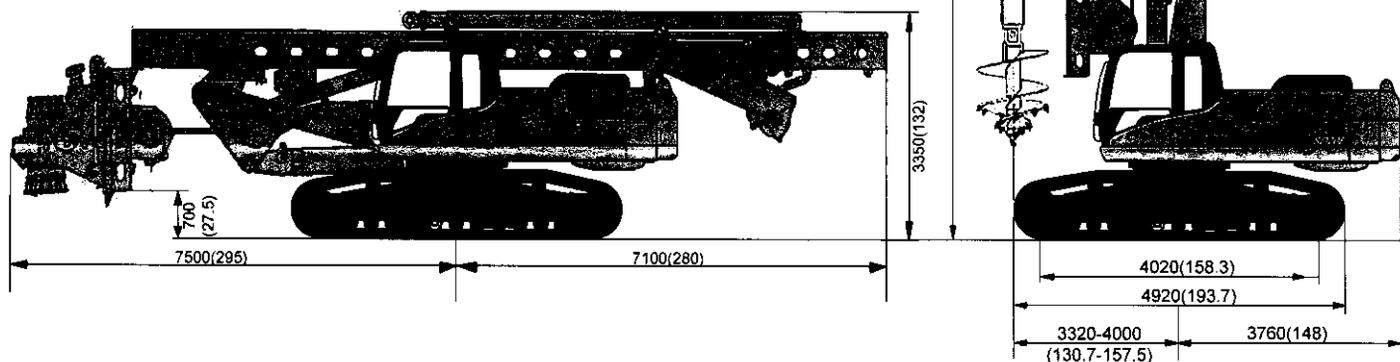
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The main features of SD20E included:

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- Advance hydraulic system
- Advance PLC monitoring and control system
- Retractable undercarriage
- Self-erection parallelogram mast support system
- High line pull main winch

Option feature included:

- Crowd winch load indicator
- Casing drive adaptor
- Kelly bar
- Drilling tools



SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**MATERIAL SAFETY DATA SHEET**

Renewable Lubricants, Inc.
P.O. Box 474
Hartville, Oh 44632
Phone: (330) 877-9982 - Fax: (330) 877-2266

TRADE NAME:	Bio-Ultimax Hydraulic Fluids AW 1000 (ISO 32-46-68)		
CAS NO:	Mixture.		
SYNONYMS:	None.		
GENERIC/CHEMICAL NAME:	Mixture.		
PRODUCT TYPE:	Hydraulic Oil, (Biodegradable)		
PREPARATION/REVISION DATE:	05/06/2009		
TRANSPORTATION EMERGENCY PH NO:	(CHEMTREC) 1-800-424-9300. Outside the U.S. (703) 527-3887		
NFPA CODE:	HEALTH: 0	FIRE: 1	REACTIVITY: 0
HMIS CODE:	HEALTH: 0	FIRE: 1	REACTIVITY: 0

SECTION 2 COMPOSITION / INFORMATION OF INGREDIENTS

- This material does not contain any chemical listed as a carcinogen or potential carcinogen by OSHA, IARC Monographs or National Toxicology Program.
- This material has no known hazards when used as directed.
- All components of this material are on the U.S. T.S.C.A. Inventory or are exempt.

SECTION 3 - PHYSICAL DATA

EVAPORATION RATE	
(n-Butyl Acetate=1)	Approx. 0
PERCENT VOLATILE:	0
BOILING POINT:	Not Determined
VAPOR PRESSURE:	<1
VAPOR DENSITY (Air = 1):	<1
	ISO 32 46 68
SPECIFIC GRAVITY (H ₂ O = 1):	.88 .88 .88
SOLUBILITY IN WATER:	Insoluble
APPEARANCE AND ODOR:	yellow liquid mild odor

SECTION 4 - HANDLING AND STORAGE

HANDLING PROCEDURES:	Keep containers closed when not in use. Wash thoroughly after handling.
STORAGE PROCEDURES:	Store in a cool and well ventilated place. Empty containers may retain product properties. Follow all MSDS / Label warnings after container is emptied. No special storage precautions required.
STORAGE TEMPERATURE:	Ambient
STORAGE PRESSURE:	Atmospheric

SECTION 5 - STABILITY AND REACTIVITY

STABILITY:	Material is normally stable at moderately elevated temperatures and pressures.
INCOMPATIBILITY:	Oxidizing agents.
POLYMERIZATION:	Will not occur.
THERMAL DECOMPOSITION:	Smoke, carbon monoxide, aldehydes and other products of incomplete combustion.

SECTION 6 - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE:	Contains vegetable oil base stock. OSHA PEL of 5 mg per cubic meter.
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EFFECTS OF OVEREXPOSURE: ACGIH STEL of 10 mg per cubic meter for mineral oil mists. May cause eye and skin irritation. Low order of toxicity.

SECTION 7 - EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION PROCEDURES: Use local exhaust ventilation to control mists or vapors. Additional ventilation or exhaust may be required to maintain air concentrations below recommended exposure limits.

GLOVES PROTECTION: Use nitrile or neoprene gloves.

EYE PROTECTION: Chemical goggles or face-shield.

RESPIRATORY PROTECTION: Under normal use conditions, respirator is not usually required. Use NIOSH/MSHA approved disposable dust/mist mask if the recommended exposure limit is exceeded. Use self-contained breathing apparatus for entry into confined space, for other poorly ventilated areas and for large spill clean-up sites.

CLOTHING RECOMMENDATION: Long sleeve shirt is recommended. Wear a chemically protective apron when contact with material may occur. Launder contaminated clothing before reuse.

SECTION 8 - EMERGENCY AND FIRST AID PROCEDURES:

ORAL: DO NOT INDUCE VOMITING. If conscious, give 2 glasses of water. Get immediate medical attention.

EYE: Flush with water at least 15 minutes. Get medical attention if eye irritation develops or persists.

SKIN: Wash with soap and water. Remove contaminated clothing. Get medical attention if irritation develops. Launder contaminated clothing before reuse.

INHALATION: Remove exposed person to fresh air if adverse effects are observed. If breathing is labored, administer oxygen. If breathing has stopped, apply artificial respiration. If irritation persists, get medical attention.

ADDITIONAL: Note to physician: Treat symptomatically.

SECTION 9-- - FIRE FIGHTING MEASURES

	ISO	32	46	68
FLASH POINT (COC)		184	199	198
UPPER FLAMMABLE LIMIT:		Not Determined.		
LOWER FLAMMABLE LIMIT:		Not Determined.		
EXTINGUISHING MEDIA:		CO ₂ , dry chemical, alcohol foam. Water can be used to cool and protect exposed material.		
SPECIAL FIRE-FIGHTING PROCEDURES:		Recommend wearing self-contained breathing apparatus. Water may cause splattering. Material will float on water.		

SECTION 10 - SPILLS OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS SPILLED OR RELEASED:
Prevent entry into sewers and waterways. Pick up free liquid for recycle/disposal. Absorb small amounts on inert material for disposal.

WASTE DISPOSAL METHOD: This material is non-hazardous for disposal under RCRA. Disposal should be in compliance with federal, state and local laws.

SECTION 11 - TOXICOLOGICAL INFORMATION

Carcinogenicity: IARC Not Listed. OSHA Not Regulated. NTP Not Listed. No Component of this product at levels greater than 0.1 % is identified as a carcinogen by ACGIH, the International Agency for Research on Cancer (IARC) or the European Commission (EC).

Reproductive toxicity: This product contains no chemicals known to cause cancer, birth defects or other reproductive harm. This material does not contain any chemical listed as a carcinogen or potential carcinogen by OSHA, IARC Monographs or National

	Toxicology Program.
Health warnings	INHALATION. Oil mist can irritate airways and lungs. SKIN CONTACT. Prolonged or repeated contact may lead to irritated skin. EYE CONTACT. Irritating to eyes. INGESTION. Could cause Stomach ache or vomiting.
Route of entry	Inhalation. Skin and/or eye contact. Ingestion.

SECTION 12 –ECOLOGICAL INFORMATION

Ultimate Biodegradation Pw1 >60% within 28 days in ASTM D-5864 Aerobic Aquatic Biodegradation of Lubricants.
Aquatic Toxicity: LC50 is greater than 1000 ppm.

SECTION 13 –DISPOSAL INFORMATION

Recycle if possible. Do not reuse containers. Dispose of in accordance with all Federal, State, and Local regulations regarding pollution and waste disposal. Product as supplied contains no listed hazardous waste. It also does not meet the definition for an unspecified corrosive or ignitable waste.

SECTION 14 –TRANSPORTATION INFORMATION

	ROAD TRANSPORT (ADR):
UN NO. Road	N/A
DOT Classification	Not regulated by DOT
ADR class	Not dangerous according to ADR.
	SEA TRANSPORT (IMDG):
Sea transport notes	Not regulated per IMDG.
	AIR TRANSPORT (IATA/ICAO):
Air transport notes	Not regulated per IATA.

SECTION 15 –REGULATORY INFORMATION

	HAZARD LABELLING:
Label for supply	EM No label required NL No label required
Risk phrases	Not classified in the Annex I of Directive 67/548/EEC. No R-phrases required
Safety phrases	Not classified. No safety phrases given.

Global Chemical Inventories-

USA	All components of this material are on the US TSCA Inventory or are exempt.
EU	All components are in compliance with the EC Seventh amendment Directive 92 /32/EEC.
Japan	All components are in compliance with the Chemical Substances Control Law of Japan.
Australia	All components are in compliance with chemical notification requirements in Australia.
Canada	All components are in compliance with the Canadian Environmental Protection Act and are
Switzerland	All components are in compliance with the Environmentally Hazardous Substances Ordinance in Switzerland.
China	All components of this product are listed on the Inventory of Existing Chemical Substances in China
Korea	All components are in compliance in Korea.
Philippines	All components are in compliance with the Philippines Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (R.A. 6969).
TSCA:	All ingredients in this product are listed or exempt from listing on the TSCA Chemical inventory.

CEPA: All ingredients in this product are listed or exempt from listing on the Canadian DSL/NDSL.
Proposition 65: This product contains no chemicals know to the state of California to cause cancer, birth defects of other reproductive harm.

SARA313: This product contains no toxic chemicals subject to the requirements of section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40CFR372)

STATE RIGHT-TO-KNOW: No listing for the following : CA Prop 65,FL, MA, MI, MN, NJ, PA, RI.

CERCLA RQ's: NONE

FEDERAL REGULATIONS:

SEC. 302 / 304 REPORTABLE QUANTITY OF EXTREMELY HAZARDOUS SUBSTANCE: **NONE**

SEC. 302 THRESHOLD PLANNING QUANTITY OF EXTREMELY HAZARDOUS SUBSTANCE: **NONE**

SEC. 311 / 312 HAZARD CATEGORIES: **NONE**

SEC. 313 AND 40 CFR 372 TOXIC CHEMICAL REPORTABLE INGREDIENTS: **NONE**

HMIS RATING: HEALTH=1 FLAMMABILITY=1 REACTIVITY=0 PP=B

WHMIS RATING: (Canada) NOT a WHMIS controlled material

SECTION 16 –OTHER INFORMATION

NA=Not Available or Not Applicable

NE=Not Established

MSDS Issue Date: 05/06/2009 Validated by: William W. Garmier

Read and follow all label directions and precautions before using the product. **KEEP OUT OF THE REACH OF CHILDREN.** Any use of these data and information must be determined by the user to be in accordance with applicable Federal, State, and Local Laws and regulations.

The information presented herein has been compiled from sources considered to be dependable and is accurate to the best of Renewable Lubricants, Inc. knowledge; however, Renewable Lubricants, Inc. makes no warranty whatsoever, expressed or implied, of **MERCHANTABILITY OF FITNESS FOR THE PARTICULAR PURPOSE**, regarding the accuracy of such data or the results to be obtained from the use thereof. Renewable Lubricants Inc. assumes no responsibility for injury to recipient or to third persons or for any damage to any property and recipient assumes all such risks.



Renewable Lubricants, Inc.

476 Griggy Rd. NE, PO Box 474

Hartville, OH 44632-0474

Voice: 330.877.9982 Fax: 330.877.2266

www.renewablelube.com

Bio-Ultimax™ Hydraulic Fluids

AW 1000 & 2000 (ISO 32, 46, 68)

STABILIZED™
by Renewable Lubricants

"Biobased Lubricants that Perform Like Synthetics"

Bio-Hydraulic Fluids, Bio-Ultimax™ 1000 & 2000, are ultimately biodegradable¹ vegetable based formulas that replace mineral oil based hydraulic fluids. Bio-Ultimax™ Hydraulic Fluids are formulated to perform in hydraulic systems that require Anti-Wear (AW), anti-rust, anti-oxidation, anti-foam, and demulsibility properties. They are highly inhibited against moisture and rusting in both fresh and sea water and pass both A and B Sequences of the ASTM D-665 Turbine Oil Rust Test. Incorporating the super high viscosity index of the Stabilized* High Oleic Base Stocks (HOBS) into the formula, increases the viscosity index past synthetic levels (Energy Conserving Formulas). Zinc-free additive systems have also been developed that are environmentally friendly and meet or exceed pump requirements.

Bio-Ultimax™ Hydraulic Fluids are designed for use in mobile and stationary hydraulic vane, piston, and gear-type pumps and have shown to have exceptional anti-wear performance. **Very little wear was encountered, 0 to 25mg (Pass), in accelerated biobased tests using Denison T-5D, Vickers 20VQ, 35VQ-25 (M-2950-S), and V-104C (ASTM D-2882) pump stand tests at pressures and temperatures ranging from 2000 to 3000 psi and from 150⁰ to 210⁰ F.** The anti-wear performance exceeds the requirements for US Steel 126 and 127, load stage 10 in the FZG (DIN 51354), DIN 51524, and GM (LS-2). They also meet the requirements for ashless GL-3 gear oils in reduction units and gear sets where they meet the viscosity ranges. Bio-Ultimax™ AW 1000 meets and exceeds Federal Specifications A-A-59354 Superseding MIL-H-46001D.

The super high viscosity index of the HOBS naturally improves the thermal shear stability of the formula and increases load capacity. The HOBS's extremely low volatility increases the flash and fire safety features in the formula. They are formulated to provide seal conditioning for longer seal life and to reduce oil leakage from the system. Bio-Ultimax™ Hydraulic Fluids should be used in hydraulic systems where low toxicity, and BIODEGRADABILITY properties are required. Base oils and additives in these products pass and exceed the acute toxicity (LC-50) criteria adopted by the US Fish and Wildlife Service and the US EPA. Bio-Ultimax™ Hydraulic Fluids are ENVIRONMENTALLY RESPONSIBLE lubricants that are formulated from renewable agricultural plant resources. We believe Earth's environmental future rests in the use of renewable materials.

STABILIZED by Renewable Lubricants™* is RLI's trademark on their proprietary and patented anti-oxidant, anti-wear, and cold flow technology. High Oleic Base Stock (HOBS) are agricultural vegetable oils. This Stabilized technology allows the HOBS to perform as a high performance formula in high and low temperature applications, reducing oil thickening and deposits.

¹ Ultimate Biodegradation (Pw1) within 28 days in ASTM D-5864 Aerobic Aquatic Biodegradation of Lubricants

Patented Product: US Patent 6,383,992, US Patent 6,534,454 with additional Pending and Foreign Patents

* Trademark of Renewable Lubricants™, Inc.

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Availability F.O.B. :Hartville, Ohio, USA

5 Gallon Pails Drums Bulk

Bio-Ultimax™ 1000 Hydraulic Fluids ISO 32, 46, 68

The test data below show that the Bio-Ultimax™ 1000 Hydraulic Fluids provide high performance in a wide variety of stationary and transportation equipment that operate in broad ranges of environmental conditions. In equipment operating outside, wear from poor cold temperature pumpability, surge loads, moisture, and dusty environments are more prominent. Bio-Ultimax™ 1000 Hydraulic Fluids are formulated to improve performance in equipment that requires excellent anti-wear, hydrolytic stability, and cold temperature pumpability as low as -35⁰C. In addition, the products may be used in machine tool hydraulic systems with the above Denison and Vickers pump requirements and exceeds the requirements of US Steel 126, 127 and DIN 51524 Part 2.

TYPICAL SPECIFICATIONS	METHOD	ISO 32	ISO 46	ISO 68	Spec. Requirements
Specific Gravity @ 15.6°C	ASTM D-287	0.88	0.88	0.88	Report
Viscosity @ 40°C	ASTM D-445	30.87	43.8	64.1	Note 1
Viscosity @ 100°C	ASTM D-445	6.9	9.67	12.5	Note 1
Viscosity @ -15°C, Brookfield	ASTM D-2983	550 cP	1100 cP	3200cP	Note 1
Viscosity @ -25°C, Brookfield	ASTM D-2983	1,200 cP	3,000 cP	4500 cP	Note 1
Viscosity @ -30°C MRV TP1	ASTM D-4684	4,500 cP	8000 cP	15,000 cP	10W= <60,000
Viscosity @ -35°C MRV TP1	ASTM D-4684	7,500 cP	11,000 cP	24,000 cP	5W= <60,000
Viscosity Index	ASTM D-2270	184	199	198	90 (min)
Pour Point	ASTM D-97	-40°C	-40°C	-39°C	Note 1
Flash Point (COC)	ASTM D-92	236°C	243°C	251°C	198°C (min)
Fire Point (COC)	ASTM D-92	260°C	268°C	274°C	218°C (min)
Hydrolytic Stability, Copper Wt. Loss (mg)	ASTM D-2619	0.0139	0.0208	0.0208	0.2
Copper Appearance		1B	1B	1B	Report
Change in Acid Number		0.16	0.20	0.21	Report
Water Layer		3.0	3.0	3.0	4
% Insolubles		0.001	0.001	0.001	Report
Foam Sequence I, II, III (10 min)	ASTM D-892	0 Foam	0 Foam	0 Foam	0 Foam
Rust Prevention Distilled Water	ASTM D-665	Pass	Pass	Pass	Pass
Syn. Sea Water		Pass	Pass	Pass	Pass
Copper Corrosion Strip 3hr @ 100°C	ASTM D-130	1B	1B	1B	DIN 51524 2(max)
Rotary Bomb Oxidation, (minutes)	ASTM D-2272	360	360	360	USS 120 (min)
Oxidation Stability (Pressure Differential Scanning Calorimeter) min	ASTM D-5483 Modified	70.0 (165°C)	70.0 (165°C)	70.0 (165°C)	Note 2
Neutralization Number mg KOH/g	ASTM D-974	<0.4	<0.4	<0.4	1.5 (max)
Swell of Synthetic NBR-L Rubber, % (Avg.) Volume Change (%)	DIN 53538, Part 1	6.0	6.0	6.0	0 to 12
Shore A Hardness Change (%)		-4	-4	-4	0 to -7
Filterability A-No Water (s) (Avg)	Denison TP 02100 HF-0 Requirement	113	268	335	600 (max)
B-2% Water (s) (Avg)		187	271	449	2xA (max)
Demulsibility, ML Oil/Water/Emulsion	ASTM D-1401	40/ 40/ 0 (10 minutes)	40/ 40/ 0 (10 minutes)	40/ 40/ 0 (10 minutes)	40/37/3 (max) (30 minutes)
4-Ball Wear, 1h, 167°F, 1200 RPM, 40 kg	ASTM D-4172	0.3 – 0.4	0.3 – 0.4	0.3 – 0.4	USS 127 0.5 (max)
FZG Test	DIN 51354	12	12	12	US.Steel 10 (min)
<u>Biodegradation Classification</u>	ASTM D-5864	Ultimate PW1	Ultimate PW1	Ultimate PW1	Ultimate PW1
<u>Environmentally Friendly</u>	ISO 15380	yes	yes	yes	
<u>USDA Biobased Tested</u>	New Carbon	yes	yes	yes	meets/exceeds
<u>Environmental Management System</u>	ISO 14001:1996	yes	yes	yes	over 50%
<i>Note 1 Viscosity Sufficient for Application</i>					
<i>Note 2 Not Required</i>					

Bio-Ultimax™ 2000 Hydraulic Fluids ISO 32, 46, 68

Bio-Ultimax™ 2000 Hydraulic Fluids are designed to provide high performance in the high temperature/high pressure machine tool environment. In machine tool equipment, the hydraulic pump may work continuously in automatic machines.

Machines may run 24 hours and 7 days a week non-stop. Close tolerances (0.00015 in. = 3 micron) and fine system filters (3 to 5 absolute filtration) for hydraulic/electric servo drive systems can work to elevate hydraulic system temperatures rapidly. It is also not unusual for hydraulic system components to be located close to very high temperature areas, i.e., on the side of a plastic mold injection gun. The very high oxidative stability of Bio-Ultimax 2000 Hydraulic Fluids meets these demands. Bio-Ultimax™ 2000 exceeds the requirements for DIN 51524 Part 2.

If oil samples are monitored and if the machine is running under clean conditions, fluid life can be increased with proper lubricant filtration and improved oxidation. Even though the US Steel requirement is a minimum of 125 minutes in the RBOT, the hydraulic system's fluid life can be increased considerably when RBOT exceeds 400 minutes and a proper preventative maintenance sampling program is used. General Electric, GEK 32568A, requires an RBOT minimum of 450 minutes in turbine oil requirements. In RLI's Bio-Ultimax™ 2000 Hydraulic Fluids, a RBOT of over 500 minutes has been met that increases fluid and equipment life.

TYPICAL SPECIFICATIONS	METHOD	ISO 32	ISO 46	ISO 68	Spec. Requirements
Specific Gravity @ 15.6°C	ASTM D-287	0.873	0.88	0.89	Report
API Gravity @ 15.6°C	ASTM D-287	30.6	29.3	27.5	Report
Viscosity @ 40°C	ASTM D-445	29.5	44.31	64.34	Note 1
Viscosity @ 100°C	ASTM D-445	6.54	9.50	12.2	Note 1
Viscosity Index	ASTM D-2270	186	206	191	90 (min)
Pour Point	ASTM D-97	-32°C	-30°C	-25°C	-12°C (max)
Flash Point (COC)	ASTM D-92	240°C	244°C	253°C	198°C (min)
Fire Point (COC)	ASTM D-92	265°C	272°C	275°C	218°C (min)
Hydrolytic Stability, Copper Wt. Loss (mg)	ASTM D-2619	0.0417	0.0208	0.0208	0.2
Copper Appearance		1A	1B	1B	Report
Water Layer		3.0	3.0	3.0	4
Foam Sequence I, II, III (10 min)	ASTM D-892	0 Foam	0 Foam	0 Foam	0 Foam
Rust Prevention	ASTM D-665	Pass	Pass	Pass	Pass
Distilled Water		Pass	Pass	Pass	Pass
Syn. Sea Water		Pass	Pass	Pass	Pass
Copper Corrosion Strip 3hr @ 100°C	ASTM D-130	1A	1A	1A	DIN 51524 2(max)
Rotary Bomb Oxidation, (minutes)	ASTM D-2272	550	550	550	USS 120 (min)
Oxidation Stability (Pressure Differential Scanning Calorimeter) min	ASTM D-5483 Modified	90 (165°C)	90 (165°C)	80 (165°C)	Note 2
Neutralization Number mg KOH/g	ASTM D-974	<0.4	<0.4	<0.4	1.5 (max)
Swell of Synthetic NBR-L Rubber, % (Avg.)	DIN 53538, Part 1	6.0	6.0	6.0	0 to 12
Volume Change (%)		-4	-4	-4	0 to -7
Shore A Hardness Change (%)					
Filterability	Denison TP 02100				
A-No Water (s) (Avg)	HF-0 Requirement	113	268	335	600 (max)
B-2% Water (s) (Avg)		187	271	449	2xA (max)
Demulsibility, ML Oil/Water/Emulsion	ASTM D-1401	40/ 40/ 0	40/ 40/ 0	40/ 40/ 0	40/37/3 (max)
4-Ball Wear, 1h, 167°F, 1200 RPM, 40 kg	ASTM D-4172	0.3 – 0.4	0.3 – 0.4	0.3 – 0.4	USS 127 0.5 (max)
FZG Test	DIN 51354	12	12	12	US.Steel 10 (min)
<u>Biodegradation Classification</u>	ASTM D-5864	Ultimate PW1	Ultimate PW1	Ultimate PW1	Ultimate PW1
<u>Environmentally Friendly</u>	ISO 15380	yes	yes	yes	meet/exceeds
<u>USDA Biobased Tested</u>	New Carbon	yes	yes	yes	over 50%
<i>Note 1 Viscosity Sufficient for Application</i>					
<i>Note 2 Not Required</i>					

Bio-Hydraulic Fluid ISO 46 Tested at DOD, Ft. Belvoir, VA
Technical Report # 13640 "L" March 1995, TARDEC-TACOM (US Army)

TYPICAL SPECIFICATIONS	METHOD	Bio-46 HYD	Mil-H 46001 Reference Mineral Oil	Spec. Requirements
Specific Gravity @ 15.6°C Viscosity @ 40°C Viscosity @ 100°C Viscosity @ -15°C, Brookfield Viscosity @ -25°C, Brookfield Viscosity @ -30°C MRV TP1 Viscosity Index	ASTM D-287 ASTM D-445 ASTM D-445 ASTM D-2983 ASTM D-2983 ASTM D-4684 ASTM D-2270	0.91 *ISO-46 47.5 9.58 1100 cP 3000 cP 15,000 cP 194	0.87 ISO-32 31.43 5.29 1544 Not Complete Not Complete 99	Report Note 1 Note 1 Note 1 Note 1 10W= <60,000(max) 90 (min)
Pour Point Flash Point (COC) Fire Point (COC) Hydrolytic Stability, Copper Wt. Loss (mg) Copper Appearance Water Layer Foam Sequence I, II, III (10 min) Rust Prevention Distilled Water Syn. Sea Water	ASTM D-97 ASTM D-92 ASTM D-92 ASTM D-2619 ASTM D-892 ASTM D-665	-36°C 278°C 335°C 0.01 1B 0.17 0 Foam Pass Pass	-39°C 212°C 234°C Not Complete Not Complete Not Complete (Fail) Pass Pass	-12°C (max) 198°C (min) 218°C (min) 0.2 Report 4 0 Foam Pass Pass
Cincinnati Machine Thermal Stability Procedure A % Vis Change Neutralization Number mg KOH/g Precipitate or sludge, mg/100ml Steel Rod Visual Condition Deposit, mg Metal Removed, mg/200 ml Copper Rod Visual Condition Deposit, mg		4.38 0.15 15.65 slight tarnish 1.5 Nil 2c 7.4	7.45 (Fail) 0.49 8.75 medium tarnish Nil Nil 4B 5.6	+5 max 0.75 25 (max) Report 3.5 (max) 1.0 (max) 5 10 (max)
Accelerated Storage Stability (@ 100° C One Month) Viscosity Changes, % @ 40°C ASTM D445 Acid Number Changes, mg PDSC, Induction Time Changes, % Copper Corrosion Strip 3 Days @ 100°C Galvanic Corrosion Corrosiveness and Oxidation Stability @ 100°C Humidity Cabinet, Hrs. to Fail	Army Method ASTM D-130 FED-STD 7915, #5322 ASTM D-4636 ASTM-D-1748	0.83 0.1 0 1B Pass Pass 230	1.43 0.03 -25.58 1A Pass Pass 48	Note 2 Note 2 Note 2 Note 2 Note 2 Note 2
Oxidation Stability (Pressure Differential Scanning Calorimeter) min Evaporation Loss, % (100°C, 1 hr) Neutralization Number mg KOH/g Swell of Synthetic NBR-L Rubber, % Demulsibility, ML Oil/Water/Emulsion 4-Ball Wear, 1h, 167°F, 1200 RPM, 40 kg Biodegradation Classification	ASTM D-5483 Modified (Thermogravimetric Analysis) ASTM D-664 FED-STD 791, #3603 ASTM D-1401 ASTM D-4172 ASTM D-5864	13.34 (180°C) 0.78 1.35 10.35 40/ 40/ 0 0.40 Yes	24.2 (180°C) 0.75 0.58 7.78 40/ 40/ 0 0.43 No	Note 2 Note 2 1.5 (max) Report 40 (max) USS 127 0.5 (max) Report
<i>Note 1 Viscosity Sufficient for Application</i> <i>Note 2 Not Required</i>				

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May be used to comply with OSHA's Hazard Communication Standard 29CFR 1910.1200. Standard must be consulted for specific requirements.

ACUTE HEALTH	1	FIRE	1	REACTIVITY	0	HAZARD RATING Least - 0 Slight - 1 Moderate - 2 High - 3 Extreme - 4
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SECTION I CHEMICAL PRODUCT IDENTIFICATION

PRODUCT: NIAGARA R&O AW 32 HYDRAULIC OIL
 CHEMICAL NAME: PETROLEUM HYDROCARBON
 SYNONYMS: HYDRAULIC OIL
 NIAGARA CODE: 0422

SECTION II COMPOSITION/INFORMATION ON INGREDIENTS

NO.	COMPOSITION	CAS NO.	%
P	NIAGARA R&O AW 32 HYDRAULIC OIL		100
1	SOLVENT REFINED HYDROTREATED HEAVY PARAFFINIC DISTILLATE	64741-89-5/64741-88-4	97-98
2	MINOR ADDITIVES*		<3
3			
4			
5			
6			
7			
8			

* ADDITIVE MANUFACTURER CONSIDERS THIS ADDITIVE PACKAGE TO BE CONFIDENTIAL BUSINESS INFORMATION AND IS BEING WITHHELD AS PERMITTED BY 29CFR 1910.1200.

SECTION IIB ACUTE TOXICITY DATA

NO.	ACUTE ORAL	ACUTE DERMAL	ACUTE INHALATION
	N.D.	N.D.	N.D.

SECTION III HEALTH INFORMATION

EFFECTS OF EXPOSURE									
OSHA PEL/TWA	N.E.	OSHA PEL/CEILING	N.E.		ACGIH TLV/TWA	N.E.	ACGIH TLV/STEL	N.E.	OTHER
IRRITATION		SKIN	X	SEVERE		MODERATE		MILD	X
		EYE	X	SEVERE		MODERATE		MILD	X
CORROSIVITY		SKIN	X						
		EYE	X			MAY CAUSE BLINDNESS			
						NOT CORROSIVE	X		

SECTION IV EMERGENCY FIRST AID

INGESTION									
INDUCE VOMITING		DO NOT INDUCE VOMITING	X	GIVE PLENTY OF WATER		GET MEDICAL ATTENTION	X	OTHER	
DERMAL									
FLUSH WITH SOAP AND WATER	X	GET MEDICAL ATTENTION	X	CONTAMINATED CLOTHING - REMOVE AND LAUNDRER	X	CONTAMINATED SHOES DESTROY		OTHER	
EYE CONTACT									
FLUSH WITH PLENTY OF WATER AT LEAST 15 MINUTES	X	GET MEDICAL ATTENTION	X					OTHER	
INHALATION									
REMOVE TO FRESH AIR	X	IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION		GIVE OXYGEN		GET MEDICAL ATTENTION	X	OTHER	

N.D. - NOT DETERMINED
 < - LESS THAN

N.A. - NOT APPLICABLE
 > - GREATER THAN

N.E. - NOT ESTABLISHED

N.R - NOT REVIEWED

SECTION V PHYSICAL DATA

BOILING POINT (deg f)	500+	MELTING POINT (deg f)	N.A.	POUR POINT (deg f)	-25	DROPPING POINT (deg f)	N.A.	VAPOR DENSITY (Air = 1)	N.A.
SPECIFIC GRAVITY (H2O=1)	.8681	SOLUBILITY IN WATER		NEGLIGIBLE	OTHER			VAPOR PRESSURE (mm hg)	N.A.
EVAPORATION RATE (N-BUTYL ACETATE=1)	N.A.	APPEARANCE & ODOR		PALE LIQUID, PETROLEUM ODOR					

SECTION VI FIRE AND EXPLOSION HAZARDS

FLASH POINT (deg f) (coc)	380+	FLAMMABLE LIMITS LOWER	N.D.	UPPER	N.D.	AUTO IGNITION TEMPERATURE/FIRE POINT UNDILUTED (deg f)	N.A.
EXTINGUISHING MEDIA							
WATER SPRAY		WATER FOG		C02	X	DRY CHEMICAL	X
EARTH AND SAND						ALCOHOL FOAM	
						FOAM	X
SPECIAL FIRE FIGHTING PROCEDURES							
DO NOT ENTER BUILDING		ALLOW FIRE TO BURN		WATER MAY CAUSE FROTHING		DO NOT USE WATER	

SECTION VII REACTIVITY DATA

STABILITY		HAZARDOUS POLYMERIZATION					
STABLE	X	UNSTABLE		WILL OCCUR		WILL NOT OCCUR	X
INCOMPATIBILITY – AVOID CONTACT WITH							
STRONG ACIDS		STRONG ALKALIS		STRONG OXIDIZERS	X	OTHER	
CONDITIONS TO AVOID							
HEAT	X	OPEN FLAMES	X	SPARKS		IGNITION SOURCES	

SECTION VIII EMPLOYEE PROTECTION

RESPIRATORY PROTECTION: IF EXPOSURE MAY OR DOES EXCEED OCCUPATIONAL EXPOSURE LIMITS, USE A NIOSH APPROVED RESPIRATOR TO PREVENT OVEREXPOSURE. IN ACCORD WITH 29 CFR 1910.134 USE EITHER AN ATMOSPHERE-SUPPLYING RESPIRATOR OR AN AIR-PURIFYING RESPIRATOR FOR ORGANIC VAPORS.
PROTECTIVE CLOTHING: WEAR CHEMICAL RESISTANT GLOVES AND OTHER PROTECTIVE CLOTHING AS REQUIRED TO MINIMIZE SKIN CONTACT, WEAR SAFETY GOGGLES TO AVOID EYE CONTACT.

SECTION X ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES: USE JUDGEMENT WHEN CLEANING LARGE SPILLS, SHUT OFF SOURCE OF LEAK, DIKE AND CONTAIN. SOAK UP WITH AN ABSORBENT SUCH AS CLAY, SAND OR OTHER SUITABLE MATERIALS, DISPOSE OF PROPERLY.

SECTION XI SPECIAL PRECAUTIONS

MINIMIZE SKIN CONTACT. WASH WITH SOAP AND WATER BEFORE EATING, DRINKING, SMOKING OR USING TOILET FACILITIES. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. STORE IN A COOL, DRY PLACE WITH ADEQUATE VENTILATION, KEEP AWAY FROM OPEN FLAMES AND HIGH TEMPERATURES.

SECTION XII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION
 NOT REGULATED

Niagara Lubricant Co., Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose. Niagara Lubricant Co., Inc. makes no representations or warranties, either expressed or implied, of merchantability, fitness for a particular purpose with respect to the information set forth herein or to the product to which the information refers. Accordingly, Niagara Lubricant Co., Inc. will not be responsible for damages resulting from use of or reliance upon this information.

DATE PREPARED: 23-August-2006

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May be used to comply with OSHA's Hazard Communication Standard 29CFR 1910.1200. Standard must be consulted for specific requirements.

ACUTE HEALTH	1	FIRE	0	REACTIVITY	0	HAZARD RATING Least - 0 Slight - 1 Moderate - 2 High - 3 Extreme - 4
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SECTION I CHEMICAL PRODUCT IDENTIFICATION

PRODUCT: FIVE STAR MULTI-GEAR GL5 85W140
 CHEMICAL NAME: PETROLEUM HYDROCARBON
 SYNONYMS: GEAR OIL
 NIAGARA CODE: 0604

SECTION II COMPOSITION/INFORMATION ON INGREDIENTS

NO.	COMPOSITION	CAS NO.	%
P	FIVE STAR MULTI-GEAR GL5 85W140		100
1	DEWAXED HEAVY PARAFFINIC PETROLEUM DISTILLATES	64742-54-7	40-80
2	SOLVENT DEWAXED RESIDUAL PETROLEUM	64742-01-4	5-40
3	ADDITIVES PACKAGE*		<15
4			
5			
6			
7			
8			

* ADDITIVE MANUFACTURER CONSIDERS THIS ADDITIVE PACKAGE TO BE CONFIDENTIAL BUSINESS INFORMATION AND IS BEING WITHHELD AS PERMITTED BY 29CFR 1910.1200.

SECTION IIB ACUTE TOXICITY DATA

NO.	ACUTE ORAL	ACUTE DERMAL	ACUTE INHALATION
	N.D.	N.D.	N.D.

SECTION III HEALTH INFORMATION

EFFECTS OF EXPOSURE									
OSHA PEL/TWA	N.E.	OSHA PEL/CEILING	N.E.		ACGIH TLV/TWA	N.E.	ACGIH TLV/STEL	N.E.	OTHER
IRRITATION		SKIN	X	SEVERE		MODERATE		MILD	X
		EYE	X	SEVERE		MODERATE		MILD	X
CORROSIVITY		SKIN	X						
		EYE	X			MAY CAUSE BLINDNESS			
						NOT CORROSIVE	X		

SECTION IV EMERGENCY FIRST AID

INGESTION									
INDUCE VOMITING		DO NOT INDUCE VOMITING	X	GIVE PLENTY OF WATER		GET MEDICAL ATTENTION	X	OTHER	
DERMAL									
FLUSH WITH SOAP AND WATER	X	GET MEDICAL ATTENTION	X	CONTAMINATED CLOTHING - REMOVE AND LAUNDRY	X	CONTAMINATED SHOES DESTROY		OTHER	
EYE CONTACT									
FLUSH WITH PLENTY OF WATER AT LEAST 15 MINUTES	X	GET MEDICAL ATTENTION	X					OTHER	
INHALATION									
REMOVE TO FRESH AIR	X	IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION		GIVE OXYGEN		GET MEDICAL ATTENTION	X	OTHER	

N.D. - NOT DETERMINED N.A. - NOT APPLICABLE
 < - LESS THAN > - GREATER THAN N.E. - NOT ESTABLISHED N.R - NOT REVIEWED

SECTION V PHYSICAL DATA

BOILING POINT (deg f)	600+	MELTING POINT (deg f)	N.A.	POUR POINT (deg f)	-25	DROPPING POINT (deg f)	N.A.	VAPOR DENSITY (Air = 1)	N.A.
SPECIFIC GRAVITY (H2O=1)	.9070	SOLUBILITY IN WATER		NEGLIGIBLE	OTHER			VAPOR PRESSURE (mm hg)	N.D.
EVAPORATION RATE (N-BUTYL ACETATE=1)	N.A.	APPEARANCE & ODOR		GREEN BLOOM, PETROLEUM ODOR					

SECTION VI FIRE AND EXPLOSION HAZARDS

FLASH POINT (deg f) (coc)	425+	FLAMMABLE LIMITS LOWER	N.D.	UPPER	N.D.	AUTO IGNITION TEMPERATURE/FIRE POINT UNDILUTED (deg f)	N.A.
EXTINGUISHING MEDIA							
WATER SPRAY		WATER FOG		C02	X	DRY CHEMICAL	X
EARTH AND SAND						ALCOHOL FOAM	
						FOAM	X
SPECIAL FIRE FIGHTING PROCEDURES							
DO NOT ENTER BUILDING		ALLOW FIRE TO BURN		WATER MAY CAUSE FROTHING		DO NOT USE WATER	

SECTION VII REACTIVITY DATA

STABILITY		HAZARDOUS POLYMERIZATION					
STABLE	X	UNSTABLE		WILL OCCUR		WILL NOT OCCUR	X
INCOMPATIBILITY – AVOID CONTACT WITH							
STRONG ACIDS		STRONG ALKALIS		STRONG OXIDIZERS	X	OTHER	
CONDITIONS TO AVOID							
HEAT	X	OPEN FLAMES	X	SPARKS		IGNITION SOURCES	

SECTION VIII EMPLOYEE PROTECTION

RESPIRATORY PROTECTION: IF EXPOSURE MAY OR DOES EXCEED OCCUPATIONAL EXPOSURE LIMITS, USE A NIOSH APPROVED RESPIRATOR TO PREVENT OVEREXPOSURE. IN ACCORD WITH 29 CFR 1910.134 USE EITHER AN ATMOSPHERE-SUPPLYING RESPIRATOR OR AN AIR-PURIFYING RESPIRATOR FOR ORGANIC VAPORS.
PROTECTIVE CLOTHING: WEAR CHEMICAL RESISTANT GLOVES AND OTHER PROTECTIVE CLOTHING AS REQUIRED MINIMIZING SKIN CONTACT, WEARING SAFETY GOGGLES TO AVOID EYE CONTACT.

SECTION X ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES: USE JUDGEMENT WHEN CLEANING LARGE SPILLS, SHUT OFF SOURCE OF LEAK, DIKE AND CONTAIN. SOAK UP WITH AN ABSORBENT SUCH AS CLAY, SAND OR OTHER SUITABLE MATERIALS, DISPOSE OF PROPERLY.

SECTION XI SPECIAL PRECAUTIONS

MINIMIZE SKIN CONTACT. WASH WITH SOAP AND WATER BEFORE EATING, DRINKING, SMOKING OR USING TOILET FACILITIES. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. STORE IN A COOL, DRY PLACE WITH ADEQUATE VENTILATION, KEEP AWAY FROM OPEN FLAMES AND HIGH TEMPERATURES.

SECTION XII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION
 NOT REGULATED

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DATE PREPARED: 26-May-2006

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ACUTE HEALTH	1	FIRE	1	REACTIVITY	0	HAZARD RATING Least - 0 Slight - 1 Moderate - 2 High - 3 Extreme - 4
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SECTION I CHEMICAL PRODUCT IDENTIFICATION

PRODUCT: FIVE STAR ULTRA TAC MOLY #2 #3
 CHEMICAL NAME: PETROLEUM HYDROCARBON
 SYNONYMS: GREASE
 NIAGARA CODE: 3000GR; 3001GR

SECTION II COMPOSITION/INFORMATION ON INGREDIENTS

NO.	COMPOSITION	CAS NO.	%
P	FIVE STAR ULTRA TAC MOLY #2 #3		100
1	HYDROTREATED NAPHTHENIC DISTILLATES	64742-54-7	>30
2	HYDROTREATED RESIDUAL OIL	64742-57-0	<50
3	12-HYDROXYSTEARIC ACID	160-14-9	<10
4	MOLYDBENUM DISULFIDE	1317-33-5	<3
5	MINOR ADDITIVES*		<4
6			
7			
8			

* ADDITIVE MANUFACTURER CONSIDERS THIS ADDITIVE PACKAGE TO BE CONFIDENTIAL BUSINESS INFORMATION AND IS BEING WITHHELD AS PERMITTED BY 29CFR 1910.1200.

SECTION IIB ACUTE TOXICITY DATA

NO.	ACUTE ORAL	ACUTE DERMAL	ACUTE INHALATION
	N.D.	N.D.	N.D.

SECTION III HEALTH INFORMATION

EFFECTS OF EXPOSURE									
OSHA PEL/TWA	N.E.	OSHA PEL/CEILING	N.E.		ACGIH TLV/TWA	N.E.	ACGIH TLV/STEL	N.E.	OTHER
IRRITATION		SKIN	X	SEVERE		MODERATE		MILD	X
		EYE	X	SEVERE		MODERATE		MILD	X
CORROSIVITY		SKIN	X						
		EYE	X			MAY CAUSE BLINDNESS			
						NOT CORROSIVE	X		

SECTION IV EMERGENCY FIRST AID

INGESTION		DO NOT INDUCE VOMITING			GIVE PLENTY OF WATER		GET MEDICAL ATTENTION	X	OTHER
DERMAL									
FLUSH WITH SOAP AND WATER	X	GET MEDICAL ATTENTION	X	CONTAMINATED CLOTHING – REMOVE AND LAUNDRER	X	CONTAMINATED SHOES DESTROY			OTHER
EYE CONTACT									
FLUSH WITH PLENTY OF WATER AT LEAST 15 MINUTES	X	GET MEDICAL ATTENTION	X						OTHER
INHALATION									
REMOVE TO FRESH AIR	X	IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION		GIVE OXYGEN		GET MEDICAL ATTENTION	X		OTHER

N.D. – NOT DETERMINED
< – LESS THAN

N.A. – NOT APPLICABLE
> – GREATER THAN

N.E. – NOT ESTABLISHED

N.R – NOT REVIEWED

SECTION V PHYSICAL DATA

BOILING POINT (deg f)	500+	MELTING POINT (deg f)	N.A.	POUR POINT (deg f)	N.A.	DROPPING POINT (deg f)	500+	VAPOR DENSITY (Air = 1)	N.A.
SPECIFIC GRAVITY (H2O=1)	0.948	SOLUBILITY IN WATER	NEGLIGIBLE	OTHER				VAPOR PRESSURE (mm hg)	N.A.
EVAPORATION RATE (N-BUTYL ACETATE=1)	N.A.	APPEARANCE & ODOR	AMBER GREASE, MINERAL OIL ODOR						

SECTION VI FIRE AND EXPLOSION HAZARDS

FLASH POINT (deg f) (coc)	>374	FLAMMABLE LIMITS LOWER	N.D.	UPPER	N.D.	AUTO IGNITION TEMPERATURE/FIRE POINT UNDILUTED (deg f)	N.A.
EXTINGUISHING MEDIA							
WATER SPRAY		WATER FOG		CO2	X	DRY CHEMICAL	X
EARTH AND SAND						ALCOHOL FOAM	
						FOAM	X
SPECIAL FIRE FIGHTING PROCEDURES							
DO NOT ENTER BUILDING		ALLOW FIRE TO BURN		WATER MAY CAUSE FROTHING		DO NOT USE WATER	

SECTION VII REACTIVITY DATA

STABILITY		HAZARDOUS POLYMERIZATION					
STABLE	X	UNSTABLE		WILL OCCUR		WILL NOT OCCUR	X
INCOMPATIBILITY – AVOID CONTACT WITH							
STRONG ACIDS		STRONG ALKALIS		STRONG OXIDIZERS	X	OTHER	
CONDITIONS TO AVOID							
HEAT	X	OPEN FLAMES	X	SPARKS		IGNITION SOURCES	

SECTION VIII EMPLOYEE PROTECTION

RESPIRATORY PROTECTION: IF EXPOSURE MAY OR DOES EXCEED OCCUPATIONAL EXPOSURE LIMITS, USE A NIOSH APPROVED RESPIRATOR TO PREVENT OVEREXPOSURE. IN ACCORD WITH 29 CFR 1910.134 USE EITHER AN ATMOSPHERE-SUPPLYING RESPIRATOR OR AN AIR-PURIFYING RESPIRATOR FOR ORGANIC VAPORS.
PROTECTIVE CLOTHING: WEAR CHEMICAL RESISTANT GLOVES AND OTHER PROTECTIVE CLOTHING AS REQUIRED TO MINIMIZE SKIN CONTACT, WEAR SAFETY GOGGLES TO AVOID EYE CONTACT.

SECTION X ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES: USE JUDGEMENT WHEN CLEANING LARGE SPILLS, SHUT OFF SOURCE OF LEAK, DIKE AND CONTAIN. SOAK UP WITH AN ABSORBENT SUCH AS CLAY, SAND OR OTHER SUITABLE MATERIALS, DISPOSE OF PROPERLY.

SECTION XI SPECIAL PRECAUTIONS

MINIMIZE SKIN CONTACT. WASH WITH SOAP AND WATER BEFORE EATING, DRINKING, SMOKING OR USING TOILET FACILITIES. LAUNDRY CONTAMINATED CLOTHING BEFORE REUSE. STORE IN A COOL, DRY PLACE WITH ADEQUATE VENTILATION, KEEP AWAY FROM OPEN FLAMES AND HIGH TEMPERATURES.

SECTION XII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION
 NOT REGULATED

Niagara Lubricant Co., Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose. Niagara Lubricant Co., Inc. makes no representations or warranties, either expressed or implied, of merchantability, fitness for a particular purpose with respect to the information set forth herein or to the product to which the information refers. Accordingly, Niagara Lubricant Co., Inc. will not be responsible for damages resulting from use of or reliance upon this information.

DATE PREPARED: 17-January-2007

ChemMasters

Installation Guidelines

CreteLox is a non-reemulsifiable, acrylic latex bonding agent and admixture. This high performance polymer is formulated as a bonding agent for cementitious mortars and toppings and as an admixture to site mixed or prepackaged cement based mortars.

1.0 General

1.1 Scope

This specification covers the performance characteristics and application procedures for providing a non-reemulsifiable, acrylic latex bonding agent and admixture. This high performance polymer is formulated as a bonding agent for cementitious mortars and toppings and as an admixture to site mixed or prepackaged cement based mortars.

1.2 Material Description

The material shall be a non-reemulsifiable, acrylic latex bonding agent and admixture that forms a permanent, positive chemical and mechanical bond to sound surfaces which may be used alone or as a slurry bond coat. As an admixture, it should increase abrasion and impact resistance with early and ultimate flexural, tensile and compressive strengths, improve chemical resistance to fertilizers, acids, and alkalis, and significantly prohibit chloride ion penetration increasing corrosion resistance of reinforcing steel.

1.3 Typical Applications

- A. Interior or exterior, above or below grade bonding agent
- B. Performance enhancing admixture for stucco, cement plaster, cementitious toppings and overlays, prepackaged and site mixed mortars
- C. Cyclically damp environments, food processing plants, water storage facilities, swimming pools
- D. Polymer modified concrete ((PMC) for bridge decks and white toppings

1.4 Limitations

- A. Do not use air entraining admixtures or cements or other admixtures.
- B. Do not apply when the surface or air temperature is, or is expected to go, below 45° F./6° C. Do not apply to frozen or frost filled surfaces.
- C. Overworking or over trowelling surface may cause blisters or delaminations.
- D. Do not seal surface with solvent based products. Organic solvents of high solvency power, xylene, toluene, lacquer thinner, etc., will soften surface if spills are not removed quickly.

1.5 Quality Assurance

The repair contractor shall have experience and proficiency specific to the repair type and shall be approved by the engineer and the material supplier. The material supplier shall provide job service as required to assure proper handling and installation of materials. The field representative shall instruct as needed to assure that handling, mixing, placing and finishing of materials are in accordance with specifications.

1.6 Delivery, Storage and Handling

The product shall be delivered in the original, unopened containers. It shall be labeled with the manufacturer's name, product name and lot number. Materials should be stored at the job site under dry conditions and at a temperature of 40° F., (4° C.) to 90° F. (32° C.).

1.7 Environmental Requirements

All materials used for the repair work shall be VOC compliant. The manufacturer shall supply the appropriate material safety data sheets upon request.

1.8 Site Conditions

A. Coverage is dependent upon surface texture and porosity.

2.0 Materials

2.1 Approved Materials and Manufacturers

2.1.1 Product Standard

CreteLox, as manufactured by ChemMasters, 300 Edwards Street, Madison, Ohio, 44057-3112, 1-800-486-7866, is considered to conform to the requirements of this specification and shall be the bonding agent or admixture used. Cretelox is a non-reemulsifiable, acrylic latex bonding agent and admixture. This high performance polymer is formulated as a bonding agent for cementitious mortars and toppings and as an admixture to site mixed or prepackaged cement based mortars.

2.1.2 Substitutions

No submittals for substitutions will be accepted after the bid date. All submittals must be made in writing to the engineer with supporting technical data sheets and test data showing complete equivalent performance.

2.2 Packaging/Coverage/Estimating

2.2.1 Packaging

Cretelox is packaged in 55 U.S. gallon /208 Liter drums and 5 gallon/18.9 Liter pails, shipped 36 pails per pallet, shrink wrapped and in 1 gallon/3.8 liter plastic jugs, packed 4 per case.

2.2.2 Estimating and Coverage

Coverage is affected by texture or porosity of substrate.

Ft.²/gallon M²/Liter

A. Bonding Agent 200-250 5-6

B. Slurry Bond Coat 400-500 10-12

C. Admixture normally 30% to 50% of standard water requirement

2.3 Storage:

Store tightly sealed containers at room temperature. Keep from freezing. If Cretelox freezes, allow it to thaw normally at room temperature. Shelf life of properly stored material is one year from date of manufacture.

2.4 Engineering Properties

Physical Properties of Modified Portland Cement Mortar

2.4.2.1 Hardness Properties

Test Method % Improvement Curing Method: Moist Dry

2.4.1.1 Shear Bond Strength (ASTM C-1042): 389% 1600%

2.4.1.2 Flexural Strength (ASTM C-348) 127% 222%

2.4.1.3 Tensile Strength (ASTM C-190) 21% 215%

2.4.1.4 Tensile Strength (ASTM C-190) 121% 215%

2.4.1.5 Compressive Strength (ASTM C-109) 94% 228%

2.4.1.6 Abrasion Resistance Taber: 298% 1400%

Comparisons are 3:1 sand/cement mortar cured 28 days.

Cretelox modified mortar was dry cured.

2.5 Accessory Materials as manufactured by ChemMasters, 300 Edwards Street, Madison, Ohio, 44057-3112, 1-800-486-7866, is considered to conform to the requirements of this specification.

3.0 Execution

3.1 References

A. Meets the requirements of ASTM C-1059, Type II, Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete when tested in accordance with ASTM C-1042.

B. Refer to ChemMasters MSDS and Technical Data Sheets

3.2 Surface Preparation:

Substrate to be repaired or topped must be clean and free of all dust, dirt, oil, grease, curing or sealing compounds or other contaminants that may interfere with proper adhesion. If ambient temperatures are above freezing, saturate prepared surface with water. Remove any puddles.

3.2 Mixing:

A. Mixing Cretelox before using. If Cretelox is to be diluted for use as an admixture, blend Cretelox with water then add dry mix.

B. Slurry bond coat requires: 2 gal./7.6 L water 2 gal./7.6 L Cretelox 94 lb. 42.6 Kg cement 50 lb./22.7 Kg sand or 50% water/50% Cretelox and measured amount of dry, packaged mortar to achieve batter consistency

C. As admixture in packaged or site mix mortars, use Cretelox to replace 50% to 100% of the normal water required.

D. Cement based masonry coatings or other thin mortars and toppings may be mixed with Cretelox alone for optimum adhesion and durability.

E. Do not mix more material than can be placed in 20 minutes. Do not over mix as this results in excessive air entrainment and loss of strength. Particular care should be taken when power mixing, 1-2 minutes maximum.

3.3 Bonding Agent Application: Apply Cretelox at a rate of 200-250 Ft.² per gallon/5-6 M² per liter with a garden type sprayer or solvent resistant roller. Place fresh concrete or mortar while Cretelox is wet.

3.4 Bonding Slurry Application: (Preferred method) Slurry should have the consistency of pancake batter. Apply to substrate with a stiff bristle brush, working bond coat into voids, cracks and corners. Place repair mortar or topping while slurry is wet or damp.

3.5 Horizontal Repairs: Replace 50% of the normal water with Cretelox. Mix and place as usual. Over working or over trowelling surface may cause blisters or peeling.

3.6 Vertical and Overhead Repairs: Replace 50%-75% of the normal water with Cretelox. Place as usual. Best results are obtained if repairs are made in 0.5 inch/1.25 cm lifts. A stiff mix is easier to place.

3.7 Cement Plaster Ceilings: Use Cretelox alone. Build up in thin coats of .25 inch/.62 cm but do not exceed 0.5 inch/1.25 cm in depth.

3.8 Curing:

- A. Cretelox modified concrete and mortar is self curing under normal conditions. Do not use curing compounds on Cretelox modified mortars or toppings. In extremely hot, dry or windy environments, keep repair area damp with wet burlap for 24 hours.
- B. Cretelox requires at least 3 consecutive days of normal drying conditions during the curing cycle. If Cretelox is used in damp or confined areas, supplemental ventilation may be necessary to facilitate full curing and drying.

11/26/2014

EMERGENCY AND FIRST AID PROCEDURES - For inhalation, remove to fresh air. Administer artificial respiration if breathing has stopped. Flush eyes with water for 15 minutes or until irritation subsides. Wash skin thoroughly with soap and warm water. In case of ingestion, DO NOT induce vomiting. Call a physician immediately.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE - Unknown
NOTES TO PHYSICIAN - None

***** VI. REACTIVITY DATA *****

STABILITY - Stable
CONDITIONS TO AVOID - Open flames or electrical spark sources
INCOMPATIBILITY (Materials to Avoid) - Strong Oxidizing Agents
HAZARDOUS DECOMPOSITION PRODUCTS - Thermal - may yield oxides of carbon
HAZARDOUS POLYMERIZATION - Will not occur
CONDITIONS TO AVOID - None known

***** VII. PRECAUTIONS FOR SAFE HANDLING AND USE *****

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED - Remove all sources of ignition. Ventilate area. Clean up with absorbent.
WASTE DISPOSAL METHOD - Aerosol Container: Do not puncture or incinerate. When all liquid is expelled, continue to depress button until gas has been exhausted.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE - Store below 120°F (49°C). Do not use or store near open flame or spark.
OTHER PRECAUTIONS - Use only as directed. Intentional misuse by deliberately concentrating vapors and inhaling content can be harmful or fatal.

***** VIII. CONTROL MEASURES *****

RESPIRATORY PROTECTION - Not normally required
VENTILATION - Sufficient to prevent exceeding recommended exposure limits
PROTECTIVE GLOVES - Optional
EYE PROTECTION - Goggles to avoid mist
OTHER PROTECTIVE EQUIPMENT - None
WORK/HYGIENIC PRACTICES - Observe good personal hygiene practice when handling

***** IX. TRANSPORTATION DATA *****

DOT SHIPPING NAME - N/A DOT HAZARD CLASS - ORM-D

* * * * *

FOR ADDITIONAL INFORMATION CONTACT: Regulatory Affairs Office
Texas Refinery Corp.
(800) 827-0722

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11/26/2014

EMERGENCY AND FIRST AID PROCEDURES - Flush eyes with large amounts of water for at least 15 minutes. Wash skin with soap and water. If injected under the skin, get medical attention immediately. In case of ingestion, DO NOT induce vomiting; lubricant may be aspirated into the lungs; call a physician immediately.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE - None known

NOTES TO PHYSICIAN - None

***** VI. REACTIVITY DATA *****

STABILITY - Stable

CONDITIONS TO AVOID - N/A

INCOMPATIBILITY (Materials to Avoid) - Strong Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS - Carbon Monoxide, Carbon Dioxide

HAZARDOUS POLYMERIZATION - Will not occur

***** VII. PRECAUTIONS FOR SAFE HANDLING AND USE *****

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED - Clean up mechanically.

WASTE DISPOSAL METHOD - Federal, State and/or Local approved disposal

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE - Normal for greases

OTHER PRECAUTIONS - None

***** VIII. CONTROL MEASURES *****

RESPIRATORY PROTECTION - None

VENTILATION - N/A

PROTECTIVE GLOVES - Not required

EYE PROTECTION - Not required

OTHER PROTECTIVE EQUIPMENT - Not required

WORK/HYGIENIC PRACTICES - Observe good personal hygiene practice when handling this lubricant.

***** IX. TRANSPORTATION DATA *****

DOT SHIPPING NAME - N/A

DOT HAZARD CLASS - N/A

FREIGHT CLASSIFICATION - Petroleum, lubricating grease
(NMFC 155250 SUB 2 CLASS 65)

* * * * *

FOR ADDITIONAL INFORMATION CONTACT: Regulatory Affairs Office
(800) 827-0711 Ext. 277

* * * * *

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11/26/2014

M A T E R I A L S A F E T Y D A T A S H E E T

TEXAS REFINERY CORP.
840 N. Main Street
Fort Worth, Texas 76164
(817) 332-1161
24 Hr. Emergency Telephone No.: CHEMTREC 800-424-9300

Preparation/Revision Date - September, 2007
Supersedes - March, 2006

***** I. PRODUCT IDENTIFICATION *****

TRADE NAME - DZL-PEP Arctic with AAT
CHEMICAL FAMILY - Petroleum hydrocarbons
PRODUCT CODE: 6375

***** II. HAZARDOUS INGREDIENTS *****

- | | | | | |
|--|-----------------|--------------|------------|--|
| 1. Solvent naphtha (petroleum), heavy aromatic | | | | |
| CAS# 64742-94-5 | PEL: 100 ppm | TLV: 100 ppm | WT.% 65-80 | |
| 2. Naphthalene* | | | | |
| CAS# 91-20-3 | PEL: 10 ppm | TLV: 10 ppm | WT.% < 7 | |
| 3. Xylene* | | | | |
| CAS# 1330-20-7 | PEL: 100 ppm | TLV: 100 ppm | WT.% < 2 | |
| 4. Trimethylbenzene | | | | |
| CAS# 25551-13-7 | PEL: Not estbl. | TLV: 25 ppm | WT.% < 2 | |
| 5. Ethyl benzene* | | | | |
| CAS# 100-41-4 | PEL: 100 ppm | TLV: 100 ppm | WT.% < 1 | |
| 6. Vinyl acetate* | | | | |
| CAS# 108-05-4 | PEL: 10 ppm | TLV: 10 ppm | WT.% < 0.3 | |

* This product contains a toxic chemical(s) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372. Each regulated chemical is present at a concentration that does not exceed the above specified upper bound concentration value.

***** III. PHYSICAL/CHEMICAL DATA *****

BOILING POINT (°F/C): > 300/149	SPECIFIC GRAVITY (H ₂ O=1): 0.9016
VAPOR PRESSURE (mm Hg): < 1 @ 100 F	PERCENT VOLATILE BY VOL.: < 75
VAPOR DENSITY (Air=1): > 1	SOLUBILITY IN WATER: Negligible
EVAPORATION RATE (Butyl Acetate=1): < 1	
APPEARANCE AND ODOR - Light amber liquid with mild petroleum odor	

***** IV. FIRE AND EXPLOSION HAZARD DATA *****

FLASH POINT (°F/C): 145/62.8(PMCC) Min.	FLAMMABLE LIMITS: Lel/Uel: N/D
EXTINGUISHING MEDIA: Foam, Dry Chemical, CO ₂	
SPECIAL FIRE FIGHTING PROCEDURES: Use air-supplied breathing equipment for enclosed areas. Cool exposed containers with water spray.	
UNUSUAL FIRE AND EXPLOSION HAZARDS: Toxic fumes may evolve on burning. Vapors may travel along the ground to a source of ignition. Container may rupture	
NFPA: HEALTH: 2 FLAMMABILITY: 2 REACTIVITY: 0	
HMIS: HEALTH: 2 FLAMMABILITY: 2 REACTIVITY: 0 PPE: B	

***** V. HEALTH HAZARD DATA *****

TLV/PEL: Not determined; see Section II
PRINCIPAL ROUTES OF EXPOSURE - Skin and Eyes
CARCINOGENS - Naphthalene is classified as A4 by ACGIH; animal carcinogen by NTP;

11/26/2014

suspected carcinogen by IARC. Ethyl benzene and vinyl acetate are also classed as suspected carcinogens by IARC.

EFFECTS OF OVER EXPOSURE - Prolonged or repeated skin contact may cause irritation or dermatitis. May cause mild to severe eye irritation. Inhalation of oil mist may be harmful to the respiratory system. Ingestion may cause irritation of the gastrointestinal lining, nausea, vomiting, diarrhea, and abdominal pain. May cause central nervous system depression.

EMERGENCY AND FIRST AID PROCEDURES - Wash skin thoroughly with soap and warm water. Flush eyes with clear water for 15 minutes or until irritation subsides. Seek medical attention. For inhalation, remove victim to fresh air and provide oxygen if breathing is difficult. In case of ingestion, DO NOT induce vomiting. Seek medical attention.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE - Unknown

NOTES TO PHYSICIAN - None

***** VI. REACTIVITY DATA *****

STABILITY - Stable CONDITIONS TO AVOID - None known
INCOMPATIBILITY (Materials to Avoid) - Strong oxidizers
HAZARDOUS DECOMPOSITION PRODUCTS - Carbon Monoxide, carbon dioxide, aldehydes and other products of incomplete combustion
HAZARDOUS POLYMERIZATION - Will not occur

***** VII. PRECAUTIONS FOR SAFE HANDLING AND USE *****

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED - Recover free liquid. Spread absorbent to spill area then pick up and place in containers. Keep product out of sewers and water courses by diking or impounding.
WASTE DISPOSAL METHOD - Federal, State and/or Local approved disposal for waste solvents.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE - Keep container closed when not in use. Store at temperatures below 120°F (49°C).
OTHER PRECAUTIONS - Avoid breathing of oil mist. Remove oil-soaked clothing and launder before reuse. Discard oil-soaked shoes.

***** VIII. CONTROL MEASURES *****

RESPIRATORY PROTECTION - NIOSH approved respirator if exposure limits are exceeded
VENTILATION - Sufficient to prevent exceeding recommended exposure limits.
PROTECTIVE GLOVES - Use chemical resistant gloves for prolonged/repeated contact.
EYE PROTECTION - Goggles if splashing could occur
OTHER PROTECTIVE EQUIPMENT - Not normally required
WORK/HYGIENIC PRACTICES - Observe good personal hygiene practice when handling

***** IX. TRANSPORTATION DATA *****

DOT SHIPPING NAME - N/A DOT HAZARD CLASS - N/A
FREIGHT CLASSIFICATION - Petroleum, lubricating oil IATA - Non-Hazardous
IMCO CLASS - Non-Hazardous

FOR ADDITIONAL INFORMATION CONTACT: Regulatory Affairs Office
(800) 827-0711 Ext. 277

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M A T E R I A L S A F E T Y D A T A S H E E T

TEXAS REFINERY CORP.
840 N. Main Street
Fort Worth, Texas 76164
(817) 332-1161

24 Hr. Emergency Telephone No.: CHEMTREC 800-424-9300

Preparation/Revision Date - May, 2007
Supersedes - May, 2005

***** I. PRODUCT IDENTIFICATION *****

TRADE NAME - Multi-Lube XKE
CHEMICAL FAMILY - Petroleum hydrocarbons
PRODUCT CODE: 6330

***** II. HAZARDOUS INGREDIENTS *****

- 1. Heavy paraffinic distillates, petroleum (oil mist)
CAS# 64742-54-7 PEL: 5mg/m³ TLV: 5mg/m³ WT.% 5-20
- 2. Solvent naphtha (petroleum), heavy aromatic
CAS# 64742-94-5 PEL: 100 ppm TLV: 100 ppm WT.% 10-25

***** III. PHYSICAL/CHEMICAL DATA *****

BOILING POINT (°F/C): > 300/149
SPECIFIC GRAVITY (H₂O=1): 0.87
VAPOR PRESSURE (mm Hg): < 1 @ 100°F
VAPOR DENSITY (Air=1): > 1
PERCENT VOLATILE BY VOL.: 15
SOLUBILITY IN WATER: Negligible
EVAPORATION RATE (Butyl Acetate=1): < 1
APPEARANCE AND ODOR - Light amber liquid with mild petroleum odor

***** IV. FIRE AND EXPLOSION HAZARD DATA *****

FLASH POINT (°F/C): 160/71 (PMCC)
FLAMMABLE LIMITS: Lel/Uel: Not Determined. See Section II
EXTINGUISHING MEDIA: Foam, Dry Chemical, CO₂
SPECIAL FIRE FIGHTING PROCEDURES: Use air-supplied breathing equipment for enclosed areas. Cool exposed containers with water spray.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors may travel along the ground to a source of ignition. Container may rupture on heating.
NFPA: HEALTH: 1 FLAMMABILITY: 2 REACTIVITY: 0
HMIS: HEALTH: 1 FLAMMABILITY: 2 REACTIVITY: 0 PPE: A

***** V. HEALTH HAZARD DATA *****

TLV/PEL 5mg/m³ (oil mist)
PRINCIPAL ROUTES OF EXPOSURE - Skin and Eyes
CARCINOGENS - None known
EFFECTS OF OVER EXPOSURE - Prolonged or repeated skin contact may cause irritation or dermatitis. May cause mild to severe eye irritation. Inhalation of oil mist may be harmful to the respiratory system. Ingestion may cause irritation of the gastrointestinal lining, nausea, vomiting, diarrhea, and abdominal pain. May cause central nervous system depression.

11/26/2014

EMERGENCY AND FIRST AID PROCEDURES - Wash skin thoroughly with soap and warm water. Flush eyes with clear water for 15 minutes or until irritation subsides. Seek medical attention. For inhalation, remove victim to fresh air and provide oxygen if breathing is difficult. In case of ingestion, DO NOT induce vomiting. Seek medical attention.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE - Unknown

NOTES TO PHYSICIAN - None

***** VI. REACTIVITY DATA *****

STABILITY - Stable

CONDITIONS TO AVOID - None known

INCOMPATIBILITY (Materials to Avoid) - Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS - Carbon Monoxide, sulfur oxides & oxides of phosphorus in case of incomplete combustion

HAZARDOUS POLYMERIZATION - Will not occur

***** VII. PRECAUTIONS FOR SAFE HANDLING AND USE *****

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED - Recover free liquid. Spread absorbent to spill area then pick up and place in containers. Keep Product out of sewers and water courses by diking or impounding.

WASTE DISPOSAL METHOD - Federal, State and/or Local approved disposal for waste oils.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE - Keep container closed when not in use. Store at temperatures below 120°F (49°C).

OTHER PRECAUTIONS - Avoid breathing of oil mist. Remove oil-soaked clothing and laundry before reuse. Discard oil-soaked shoes.

***** VIII. CONTROL MEASURES *****

RESPIRATORY PROTECTION - Not normally required

VENTILATION - Sufficient to prevent exceeding recommended exposure for the Solvent portion.

PROTECTIVE GLOVES - Use chemical resistant gloves to avoid prolonged or repeated contact.

EYE PROTECTION - Shielded safety glasses or goggles if splashing could occur

OTHER PROTECTIVE EQUIPMENT - Not normally required

WORK/HYGIENIC PRACTICES - Observe good personal hygiene practice when handling

***** IX. TRANSPORTATION DATA *****

DOT SHIPPING NAME - N/A

DOT HAZARD CLASS - N/A

FREIGHT CLASSIFICATION - Petroleum, lubricating oil (NMFC 155250 SUB 2 CLASS 65)

FOR ADDITIONAL INFORMATION CONTACT: Regulatory Affairs Office
(800) 827-0711 Ext. 277

* * * * *

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M A T E R I A L S A F E T Y D A T A S H E E T

TEXAS REFINERY CORP.
840 N. Main Street
Fort Worth, Texas 76164
(817) 332-1161

24 Hr. Emergency Telephone No.: CHEMTREC 800-424-9300

Preparation/Revision Date - May, 2007
Supersedes - March, 2006

***** I. PRODUCT IDENTIFICATION *****

TRADE NAME - Seal Saver Plus
CHEMICAL FAMILY - Petroleum hydrocarbons
PRODUCT CODE: 6645

***** II. HAZARDOUS INGREDIENTS *****

Heavy paraffinic distillates, petroleum (oil mist)
CAS# 64742-54-7 PEL: 5mg/m³ TLV: 5mg/m³ WT.% 80-95
This material is not known to contain any chemicals on the SARA Section 313 list at a concentration greater than 1.0% or any carcinogenic chemical at a concentration greater than 0.1%.

***** III. PHYSICAL/CHEMICAL DATA *****

BOILING POINT (°F/C): > 550/288 SPECIFIC GRAVITY (H₂O=1): 0.88
VAPOR PRESSURE (mm Hg): < 0.1 @ 20°C PERCENT VOLATILE BY VOL.: Negligible
VAPOR DENSITY (Air=1): > 2 SOLUBILITY IN WATER: Negligible
EVAPORATION RATE (n Butyl Acetate=1): < 1
APPEARANCE AND ODOR - Amber color liquid with mild petroleum odor

***** IV. FIRE AND EXPLOSION HAZARD DATA *****

FLASH POINT (°F/C): > 350/177 Min. (COC)
FLAMMABLE LIMITS: Lel 0.9% Uel 7%
EXTINGUISHING MEDIA: Foam, Dry Chemical, CO₂
SPECIAL FIRE FIGHTING PROCEDURES: Use air-supplied breathing equipment for enclosed areas. Cool exposed containers with water spray.
UNUSUAL FIRE AND EXPLOSION HAZARDS: DO NOT store or mix with strong oxidants.
NFPA: HEALTH: 0 FLAMMABILITY: 1 REACTIVITY: 0
HMIS: HEALTH: 0 FLAMMABILITY: 1 REACTIVITY: 0

***** V. HEALTH HAZARD DATA *****

TLV/PEL: 5mg/m³ (oil mist)
PRINCIPAL ROUTES OF EXPOSURE - Inhalation and skin
CARCINOGENS - None known
EFFECTS OF OVEREXPOSURE - Prolonged or repeated skin contact may cause irritation. May cause mild eye irritation. Inhalation of oil mist may be harmful to the respiratory system.
EMERGENCY AND FIRST AID PROCEDURES - Wash skin thoroughly with soap and warm water. Flush eyes with clear water for 15 minutes or until irritation subsides. For inhalation, remove victim to fresh air and provide oxygen if breathing is difficult. In case of ingestion, DO NOT induce vomiting. Contact physician immediately.

11/26/2014

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE - None known

NOTES TO PHYSICIAN - None

***** VI. REACTIVITY DATA *****

STABILITY - Stable CONDITIONS TO AVOID - None known
INCOMPATIBILITY (Materials to Avoid) - Strong oxidizers, acids and reducing agents
HAZARDOUS DECOMPOSITION PRODUCTS - Oxides of carbon, sulfur, phosphorus and zinc in case of incomplete combustion.
HAZARDOUS POLYMERIZATION - Will not occur

***** VII. PRECAUTIONS FOR SAFE HANDLING AND USE *****

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED - Recover free liquid. Spread absorbent to spill area and then pick up and place in containers. Keep product out of sewers and water courses by diking or impounding.
WASTE DISPOSAL METHOD - Federal, State and/or Local approved disposal for a waste oil.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE - Keep containers closed when not in use. Store at temperatures below 120°F (49°C).
OTHER PRECAUTIONS - Avoid breathing of oil mist. Remove oil-soaked clothing and launder before re-use. Discard oil-soaked shoes.

***** VIII. CONTROL MEASURES *****

RESPIRATORY PROTECTION - Not required under normal conditions
VENTILATION - N/A
PROTECTIVE GLOVES - Not required
EYE PROTECTION - Goggles or shielded safety glasses if splashing could occur
OTHER PROTECTIVE EQUIPMENT - Not required
WORK/HYGIENIC PRACTICES - Observe good personal hygiene practice when handling this material.

***** IX. TRANSPORTATION DATA *****

DOT SHIPPING NAME - N/A
DOT HAZARD CLASS - N/A
UN/NA NUMBER - N/A
DOT LABEL(S) - N/A
FREIGHT CLASSIFICATION - Petroleum, lubricating oil (NMFC 155250 SUB 2 CLASS 65)

* * * * *

FOR ADDITIONAL INFORMATION CONTACT: Regulatory Affairs Office
(800) 827-0711 Ext. 277

* * * * *

THIS INFORMATION IS BEING SUPPLIED TO YOU UNDER OSHA "RIGHT TO KNOW" REGULATION 29 CFR 1910.1200 AND IS OFFERED IN GOOD FAITH. THE INFORMATION CONTAINED HEREIN IS BASED ON THE DATA AVAILABLE TO US AND IS BELIEVED TO BE TRUE AND ACCURATE. NO WARRANTY, EXPRESSED OR IMPLIED, REGARDING THE ACCURACY OF THIS DATA, THE HAZARDS CONNECTED WITH THE USE OF THE MATERIAL, OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF, IS MADE. TEXAS REFINERY CORP. ASSUMES NO RESPONSIBILITY FOR DAMAGE OR INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN.



CONSTRUCTION DRILLING PRODUCTS

MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name SHORE PAC®
Version # 09
Revision date 10-Jul-2008
Chemical name Copolymer of Sodium Acrylate and Acrylamide
Chemical description Powder
CAS # Mixture
Manufacturer information CETCO
Construction Drilling Products
One North Arlington
1500 W. Shure Drive
Arlington Heights, IL 60004 US
safetydata@amcol.com
<http://www.constructiondrilling.com/>
General Information (800) 527-9948
CHEMTREC® (800) 424-9300

2. Hazards Identification

Emergency overview Health injuries are not known or expected under normal use. No hazards resulting from the material as supplied.

OSHA regulatory status This product is considered not hazardous under 29 CFR 1910.1200 (Hazard Communication).

Potential health effects

- Eyes** Contact with eyes may cause irritation.
- Skin** This product may cause irritation to the skin.
- Inhalation** Inhalation of dusts may cause respiratory irritation.
- Ingestion** Health injuries are not known or expected under normal use.

3. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

4. First Aid Measures

First aid procedures

- Eye contact** Flush eyes with water as a precaution. Get medical attention if irritation develops or persists.
- Skin contact** Wash off with soap and water. Launder contaminated clothing before reuse. Get medical attention if irritation develops or persists.
- Inhalation** Remove to fresh air. Call a physician if symptoms develop or persist.
- Ingestion** Have victim rinse mouth thoroughly with water. If ingestion of a large amount does occur, seek medical attention.

General advice If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media Small Fires: Dry chemical, CO₂, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.

6. Accidental Release Measures

Environmental precautions Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Sweep up or gather material and place in appropriate container for disposal. Avoid dust formation. Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

7. Handling and Storage

Handling Handle and open container with care. Minimize dust generation and accumulation.
Storage Keep the container tightly closed and dry.

8. Exposure Controls / Personal Protection

Personal protective equipment

Eye / face protection Avoid contact with eyes. Wear dust goggles.
Skin protection Not normally needed. Wear suitable protective clothing.
Respiratory protection No personal respiratory protective equipment normally required. Use a particulate filter respirator for particulate concentrations exceeding the Occupational Exposure Limit.

9. Physical & Chemical Properties

Appearance Free flowing wettable powder.
Color White.
Odor Not available.
Odor threshold Not available.
Physical state Solid.
Form Solid. Powder.
pH Not available.
Melting point Not available.
Freezing point Not available.
Boiling point Not available.
Flash point Not available.
Evaporation rate Not available.
Flammability Not available.
Flammability limits in air, upper, % by volume Not available.
Flammability limits in air, lower, % by volume Not available.
Vapor pressure Not available.
Vapor density Not available.
Specific gravity 0.8 - 1
Relative density Not available.
Solubility (water) Solubility limited by viscosity
Partition coefficient (n-octanol/water) Not available.
Auto-ignition temperature Not available.
Decomposition temperature Not available.
VOC 0 % estimated
Percent volatile 0 % estimated

10. Chemical Stability & Reactivity Information

Chemical stability Stable at normal conditions.
Incompatible materials Strong oxidizing agents.
Hazardous decomposition products Upon decomposition, this product may yield oxides of nitrogen and ammonia, carbon dioxide, carbon monoxide and other low molecular weight hydrocarbons.
Possibility of hazardous reactions Will not occur.

11. Toxicological Information

Further information This product has no known adverse effect on human health.

12. Ecological Information

Ecotoxicity This material is not expected to be harmful to aquatic life.
Environmental effects Ecological injuries are not known or expected under normal use.
Persistence and degradability Not available.

13. Disposal Considerations

Disposal instructions Dispose in accordance with all applicable regulations.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
CERCLA/SARA Hazardous Substances - Not applicable.

OSHA Process Safety Standard: This material is not known to be hazardous by the OSHA Highly Hazardous Process Safety Standard, 29 CFR 1910.119.

CERCLA (Superfund) reportable quantity

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations

This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information**HMIS ratings**

HMIS®	
HEALTH	/ 0
FLAMMABILITY	0
PHYSICAL HAZARD	0
PERSONAL PROTECTION	

NFPA ratings

Health: 0
Flammability: 0
Instability: 0

Disclaimer

Third party materials: Insofar as materials not manufactured or supplied by this manufacturer are used in conjunction with, or instead of this product, it is the responsibility of the customer to obtain, from the manufacturer or supplier, all technical data and other properties relating to these and other materials and to obtain all necessary information relating to them. No liability can be accepted in respect of the use of this product in conjunction with materials from another supplier.

Issue date

10-Jul-2008



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 1 Chemical Product and Company Information

SUPPLIER'S NAME.....	NOCO ENERGY CORP
SUPPLIER'S ADDRESS.....	700 Grand Island Blvd., Tonawanda, NY 14150
SUPPLIER NUMBER.....	1-800-500-6626
SUPPLIER IDENTIFIER.....	Conventional Gasoline
EMERGENCY PHONE NUMBER	1-800-424-9300 Chemtrec
SYNONYM.....	87 Octane, 89 Octane, 93 Octane
PRODUCT USE.....	Motor Fuel

Section 2 Composition/Information on Ingredients

Component	CAS No.	Amount (Vol%)
LIGHT PETROLEUM DISTILLATE	8006-61-9	0 - 99.9
TOLUENE	108-88-3	0 - 30
XYLENE	1330-20-7	0 - 25
CYCLOHEXANE	110-82-7	0 - 9
ETHYL BENZENE	100-41-4	0 - 5
N-HEXANE	110-54-3	0 - 5
NAPHTHALENE	91-20-3	0 - 5
1,2,4-TRIMETHYLBENZENE	95-63-6	0 - 5
BENZENE	71-43-2	0.1 - 4.9
CUMENE	98-82-8	0 - 1

EXPOSURE GUIDELINES

	CAS No.	Governing Body	Exposure Limits		
BENZENE	71-43-2	ACGIH	STEL	2.5	ppm
BENZENE	71-43-2	OSHA	STEL	5	ppm
BENZENE	71-43-2	ACGIH	TWA	0.5	ppm
BENZENE	71-43-2	OSHA	TWA	1	ppm
CUMENE	98-82-8	ACGIH	TWA	50	ppm
CUMENE	98-82-8	OSHA	TWA	50	ppm
CYCLOHEXANE	110-82-7	ACGIH	TWA	100	ppm
CYCLOHEXANE	110-82-7	OSHA	TWA	300	ppm
ETHYL BENZENE	100-41-4	ACGIH	STEL	125	ppm
ETHYL BENZENE	100-41-4	ACGIH	TWA	100	ppm
ETHYL BENZENE	100-41-4	OSHA	TWA	100	ppm
N-HEXANE	110-54-3	ACGIH	TWA	50	ppm
N-HEXANE	110-54-3	OSHA	TWA	500	ppm
NAPHTHALENE	91-20-3	ACGIH	STEL	15	ppm
NAPHTHALENE	91-20-3	ACGIH	TWA	10	ppm
NAPHTHALENE	91-20-3	OSHA	TWA	10	ppm
TOLUENE	108-88-3	OSHA	C	300	ppm
TOLUENE	108-88-3	NIOSH	STEL	150	ppm
TOLUENE	108-88-3	ACGIH	TWA	50	ppm
TOLUENE	108-88-3	OSHA	TWA	200	ppm
XYLENE	1330-20-7	ACGIH	STEL	150	ppm
XYLENE	1330-20-7	ACGIH	TWA	100	ppm
XYLENE	1330-20-7	OSHA	TWA	100	ppm
LIGHT PETROLEUM DISTILLATE	8006-61-9	ACGIH	STEL	500	ppm
LIGHT PETROLEUM DISTILLATE	8006-61-9	ACGIH	TWA	300	ppm



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 3 Fire and Explosion Hazard of Product

CONDITIONS OF FLAMMABILITY.....	Danger! Extremely flammable liquid! Vapors may explode!
MEANS OF EXTINCTION.....	Use dry chemical, foam or carbon dioxide to extinguish fire. Use water spray to disperse gas or vapor and to protect personnel attempting to stop a leak. Use water to flush spills away from sources of ignition. Do not flush down public sewers.
FLASHPOINT & METHOD OF DETERMINATION.....	-37.00°C (-35°F) TCC
UPPER EXPLOSION LIMIT (% BY VOL.).....	7.6
LOWER EXPLOSION LIMIT (% BY VOL.).....	1.4
AUTO-IGNITION TEMPERATURE.....	444.00°C (833°F)
HAZARDOUS COMBUSTION PRODUCTS.....	Smoke or combustion.
EXPLOSION DATA.....	Irritating or toxic substances may be emitted upon thermal decomposition. Dangerous when exposed to heat or explosion hazard. Runoff to sewer may cause fire or explosion. Containers may explode in heat of fire.
SENSITIVITY TO STATIC DISCHARGE.....	N/A.

Hazards Ratings:

Key: 0 = least, 1 = slight, 2 = moderate, 3 = high, 4 = extreme

	<u>Health</u>	<u>Fire</u>	<u>Reactivity</u>	<u>PPI</u>
NFPA	1	3	0	
HMIS	2	3	0	X

Section 4 First Aid Measures

SPECIFIC FIRST AID PROCEDURES	
SKIN CONTACT.....	Remove contaminated clothing immediately. Wash area of contact thoroughly with soap and water. Get medical attention if irritation persists. High pressure injections are serious medical emergencies. Get immediate medical attention.
INGESTION.....	<u>DO NOT INDUCE VOMITING BECAUSE OF DANGER OF ASPIRATING LIQUID INTO LUNGS.</u> Get immediate medical attention. If spontaneous vomiting occurs, monitor for breathing difficulty.
INHALATION.....	Remove affected person from source of exposure. If not breathing ensure open airway and institute CPR. If breathing is difficult, administer oxygen if available. Get medical attention.
EYE CONTACT.....	Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from eyeball to ensure thorough rinsing. Get medical attention if irritation persists.

Section 5 Fire Fighting Measures

• EXTINGUISHING MEDIA

The following media may be used to extinguish a fire involving this material: Water spray; Regular foam; Dry chemical; Carbon dioxide;

• FIRE FIGHTING INSTRUCTIONS

Use water spray to cool fire exposed tanks and containers. Wear structural fire fighting gear. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 5 Fire Fighting Measures (continued)

FLAMMABLE PROPERTIES

	Typical	Minimum	Maximum	Text Result	Units	Method
<i>Flash Point</i>				-40 ESTIMATED	F	N/A
<i>Autoignition Temperature</i>				750 ESTIMATED	F	N/A
<i>Lower Explosion Limit</i>	1.5				%	N/A
<i>Upper Explosion Limit</i>	7.6				%	N/A

Section 6 Accidental Release Measures

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction: stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater. Professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if it is safe to do so. Protect bodies of water by diking, absorbents or absorbent boom. Do not flush down sewer or drainage system. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or area/equipment that require protection.

Take up with sand or other absorbent materials. Carefully shovel or sweep up into a waste container for reclamation or disposal – use caution because flammable vapors may accumulate in closed containers.

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see section 8)

Section 7 Handling and Storage

• HANDLING

Use only in a well-ventilated area. Ground and bond containers when transferring material. NFPA class IA storage. Flash point is less than 73 degrees F and boiling point is less than 100 degrees F. Avoid breathing (dust, vapor, mist, gas). Avoid prolonged or repeated contact with skin. Avoid contact with eyes. Wash thoroughly after handling. Never siphon by mouth.

• STORAGE

Keep away from heat, sparks, and flame. Keep container closed when not in use. Consult NFPA and / or OSHA codes for additional information.

Section 8 Exposure Controls and Personal Protection

Consult With a Health and Safety Professional for Specific Selections

• ENGINEERING CONTROLS

Use with adequate ventilation. Use explosion-proof ventilation equipment.

• PERSONAL PROTECTION

▪ EYE PROTECTION

Use chemical splash goggles and face shield (ANSI Z87.1 or approved equivalent).



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 8 Exposure Controls and Personal Protection (continued)

▪ **GLOVES or HAND PROTECTION**

The glove(s) listed below may provide protection against permeation. Gloves of other chemically resistant materials may not provide adequate protection. Protective gloves are recommended to protect against contact with product.

Polyethylene; Neoprene; Nitrile; Polyvinyl alcohol; Viton;

▪ **RESPIRATORY PROTECTION**

Concentration in air determines the level of respiratory protection needed. Use only NIOSH certified respiratory equipment. Half-mask air purifying respirator with organic vapor cartridges is acceptable for exposures to ten (10) times the exposure limit. Full-face air purifying respirator with organic vapor cartridges is acceptable for exposures to fifty (50) times the exposure limit. Exposure should not exceed the cartridge limit of 1000 ppm. Protection by air purifying respirators is limited. Use a positive pressure-demand full-face supplied air respirator or SCBA for exposures greater than fifty (50) times the exposure limit. If exposure is above the IDLH (Immediately Dangerous to Life and Health) or there is the possibility of an uncontrolled release, or exposure levels are unknown, then use a positive pressure-demand full-face supplied air respirator with escape bottle or SCBA. Wear a NIOSH-approved (or equivalent) full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

▪ **OTHER**

Where splashing is possible, full chemically resistant protective clothing (e.g., acid suit) and boots are required. The following materials are acceptable for use as protective clothing: Polyvinyl alcohol (PVA); Polyethylene; Neoprene; Nitrile; Viton; Polyurethane; Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Remove contaminated clothing and wash before reuse. For non-fire emergencies, positive pressure SCBA and structural firefighter's protective clothing will provide only limited protection.

Section 9 Physical /Chemical Properties

PHYSICAL STATE.....	Not determined
ODOUR AND APPEARANCE.....	Clear liquid with a strong hydrocarbon odor
ODOUR THRESHOLD.....	Not Determined
SPECIFIC GRAVITY.....	0.72 - 0.74 @ 60°F
VAPOUR PRESSURE.....	760.00 MM HG @ 100°F
VAPOUR DENSITY (air=1).....	1.2 as Vapor
EVAPORATION RATE.....	(Water = 1); >1
BOILING POINT.....	13.0°C (55°F)
FREEZING POINT.....	Not determined
pH.....	Not determined
COEFFICIENT OF WATER/OIL DISTRIBUTION.....	Negligible
% VOLATILE.....	100 % by weight

Section 10 Stability and Reactivity Data

CHEMICAL STABILITY.....	Stable
INCOMPATIBLE MATERIALS.....	Avoid contact with strong oxidizers.
CONDITIONS TO AVOID.....	Avoid heat, sparks, and open flame
CONDITIONS OF REACTIVITY.....	Stable under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS.....	Combustion may produce CO, CO ² and reactive hydrocarbons

Section 11 Toxicological Information

• **POTENTIAL HEALTH EFFECTS**

▪ **PRE-EXISTING MEDICAL CONDITIONS**

The following diseases or disorders may be aggravated by exposure to this product: Skin; Eye; Blood forming organs; Nervous system, Respiratory system; Lung (asthma-like conditions); Cardiovascular system,



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 11 Toxicological Information (continued)

INHALATION

High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, paralysis and loss of consciousness and even death). Excessive exposure to mists or vapors generated by heat may cause irritation to eyes, nose, throat, lungs and respiratory tract. Repeated excessive exposures may cause blood disorders such as anemia and leukemia. Contains a material that has been related to cancer in humans.

LC50 (mg/l): no data

LC50 (mg/m3): no data

LC50 (ppm): no data

SKIN

Moderately irritating to the skin. Skin absorption of material may produce systemic toxicity. Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis (rash).

Draize Skin Score: 4.8 Out of 8.0

LD50 (mg/kg): no data

EYES

Moderately irritating to the eyes.

INGESTION

Product may be harmful or fatal if swallowed. Pulmonary aspiration hazard. After ingestion, may enter lungs and produce damage. Irritating to mouth, throat, and stomach.

LD50 (g/kg): no data

Section 12 Ecological Information

Keep out of sewers, drainage areas, and waterways. Report spills and releases under Federal and State regulations.

Section 13 Disposal Considerations

This substance, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however it could be hazardous if it is considered toxic, corrosive, ignitable, or reactive according to Federal definitions.

Section 14 Transportation Information

SPECIAL SHIPPING INFORMATION.....	Ground lines and equipment used during transfer to reduce the possibility of static soaked-initiated fire or explosion
HAZARD CLASS.....	3, flammable liquid
DOT SHIPPING NAME.....	Gasoline
DOT IDENTIFICATION NUMBER.....	UN 1203
PACKING GROUP.....	PG II

Section 15 Regulatory Information

US FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and it's constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and or local reporting requirements. This product and/or it's constituents may also be subject to other federal, state, or local regulations. Consult the regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to navigable waters or adjoining shorelines sufficient to cause any visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Resource Center (1-800-424-8802) or, if not practical, the U.S.



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 15 Regulatory Information (continued)

Coast Guard with follow-up to the National Response Center as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g. SARA Section 304 as well as the Clean Water Act, if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 – HAZARD CLASSES

<u>ACUTE HEALTH</u>	<u>CHRONIC HEALTH</u>	<u>FIRE</u>	<u>SUDDEN RELEASE OF PRESSURE</u>	<u>REACTIVE</u>
X	X	X	---	---

Regulatory List	Component	CAS No.
ACGIH - Occupational Exposure Limits - Carcinogens	BENZENE	71-43-2
ACGIH - Occupational Exposure Limits - Carcinogens	ETHYL BENZENE	100-41-4
ACGIH - Occupational Exposure Limits - Carcinogens	NAPHTHALENE	91-20-3
ACGIH - Occupational Exposure Limits - Carcinogens	TOLUENE	108-88-3
ACGIH - Occupational Exposure Limits - Carcinogens	XYLENE	1330-20-7
ACGIH - Occupational Exposure Limits - TWAs	BENZENE	71-43-2
ACGIH - Occupational Exposure Limits - TWAs	CUMENE	98-82-8
ACGIH - Occupational Exposure Limits - TWAs	CYCLOHEXANE	110-82-7
ACGIH - Occupational Exposure Limits - TWAs	ETHYL BENZENE	100-41-4
ACGIH - Occupational Exposure Limits - TWAs	N-HEXANE	110-54-3
ACGIH - Occupational Exposure Limits - TWAs	NAPHTHALENE	91-20-3
ACGIH - Occupational Exposure Limits - TWAs	TOLUENE	108-88-3
ACGIH - Occupational Exposure Limits - TWAs	XYLENE	1330-20-7
ACGIH - Short Term Exposure Limits	BENZENE	71-43-2
ACGIH - Short Term Exposure Limits	ETHYL BENZENE	100-41-4
ACGIH - Short Term Exposure Limits	LIGHT PETROLEUM DISTILLATE	8006-61-9
ACGIH - Short Term Exposure Limits	NAPHTHALENE	91-20-3
ACGIH - Short Term Exposure Limits	XYLENE	1330-20-7
ACGIH - Skin Absorption Designation	BENZENE	71-43-2
ACGIH - Skin Absorption Designation	N-HEXANE	110-54-3
ACGIH - Skin Absorption Designation	NAPHTHALENE	91-20-3
ACGIH - Skin Absorption Designation	TOLUENE	108-88-3
CAA (Clean Air Act) - HON Rule - Organic HAPs	BENZENE	71-43-2
CAA (Clean Air Act) - HON Rule - Organic HAPs	CUMENE	98-82-8
CAA (Clean Air Act) - HON Rule - Organic HAPs	ETHYL BENZENE	100-41-4
CAA (Clean Air Act) - HON Rule - Organic HAPs	N-HEXANE	110-54-3
CAA (Clean Air Act) - HON Rule - Organic HAPs	NAPHTHALENE	91-20-3
CAA (Clean Air Act) - HON Rule - Organic HAPs	TOLUENE	108-88-3
CAA (Clean Air Act) - HON Rule - Organic HAPs	XYLENE	1330-20-7
CAA (Clean Air Act) - HON Rule - SOCM Chemicals	BENZENE	71-43-2
CAA (Clean Air Act) - HON Rule - SOCM Chemicals	CUMENE	98-82-8
CAA (Clean Air Act) - HON Rule - SOCM Chemicals	CYCLOHEXANE	110-82-7
CAA (Clean Air Act) - HON Rule - SOCM Chemicals	ETHYL BENZENE	100-41-4
CAA (Clean Air Act) - HON Rule - SOCM Chemicals	N-HEXANE	110-54-3
CAA (Clean Air Act) - HON Rule - SOCM Chemicals	NAPHTHALENE	91-20-3
CAA (Clean Air Act) - HON Rule - SOCM Chemicals	TOLUENE	108-88-3
CAA (Clean Air Act) - HON Rule - SOCM Chemicals	XYLENE	1330-20-7



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 15 Regulatory Information (continued)

CAA - 1990 Hazardous Air Pollutants	BENZENE	71-43-2
CAA - 1990 Hazardous Air Pollutants	CUMENE	98-82-8
CAA - 1990 Hazardous Air Pollutants	ETHYL BENZENE	100-41-4
CAA - 1990 Hazardous Air Pollutants	N-HEXANE	110-54-3
CAA - 1990 Hazardous Air Pollutants	NAPHTHALENE	91-20-3
CAA - 1990 Hazardous Air Pollutants	TOLUENE	108-88-3
CAA - 1990 Hazardous Air Pollutants	XYLENE	1330-20-7
Canada - WHMIS - Ingredient Disclosure	1,2,4-TRIMETHYLBENZENE	95-63-6
Canada - WHMIS - Ingredient Disclosure	BENZENE	71-43-2
Canada - WHMIS - Ingredient Disclosure	CUMENE	98-82-8
Canada - WHMIS - Ingredient Disclosure	CYCLOHEXANE	110-82-7
Canada - WHMIS - Ingredient Disclosure	ETHYL BENZENE	100-41-4
Canada - WHMIS - Ingredient Disclosure	LIGHT PETROLEUM	8006-61-9
	DISTILLATE	
Canada - WHMIS - Ingredient Disclosure	N-HEXANE	110-54-3
Canada - WHMIS - Ingredient Disclosure	NAPHTHALENE	91-20-3
Canada - WHMIS - Ingredient Disclosure	TOLUENE	108-88-3
CERCLA/SARA - Haz Substances and their RQs	BENZENE	71-43-2
CERCLA/SARA - Haz Substances and their RQs	BENZENE	71-43-2
CERCLA/SARA - Haz Substances and their RQs	CUMENE	98-82-8
CERCLA/SARA - Haz Substances and their RQs	CUMENE	98-82-8
CERCLA/SARA - Haz Substances and their RQs	CYCLOHEXANE	110-82-7
CERCLA/SARA - Haz Substances and their RQs	CYCLOHEXANE	110-82-7
CERCLA/SARA - Haz Substances and their RQs	ETHYL BENZENE	100-41-4
CERCLA/SARA - Haz Substances and their RQs	ETHYL BENZENE	100-41-4
CERCLA/SARA - Haz Substances and their RQs	N-HEXANE	110-54-3
CERCLA/SARA - Haz Substances and their RQs	N-HEXANE	110-54-3
CERCLA/SARA - Haz Substances and their RQs	NAPHTHALENE	91-20-3
CERCLA/SARA - Haz Substances and their RQs	NAPHTHALENE	91-20-3
CERCLA/SARA - Haz Substances and their RQs	TOLUENE	108-88-3
CERCLA/SARA - Haz Substances and their RQs	TOLUENE	108-88-3
CERCLA/SARA - Haz Substances and their RQs	XYLENE	1330-20-7
CERCLA/SARA - Haz Substances and their RQs	XYLENE	1330-20-7
CERCLA/SARA - Section 313 - Emission Reporting	1,2,4-TRIMETHYLBENZENE	95-63-6
CERCLA/SARA - Section 313 - Emission Reporting	BENZENE	71-43-2
CERCLA/SARA - Section 313 - Emission Reporting	CUMENE	98-82-8
CERCLA/SARA - Section 313 - Emission Reporting	CYCLOHEXANE	110-82-7
CERCLA/SARA - Section 313 - Emission Reporting	ETHYL BENZENE	100-41-4
CERCLA/SARA - Section 313 - Emission Reporting	N-HEXANE	110-54-3
CERCLA/SARA - Section 313 - Emission Reporting	NAPHTHALENE	91-20-3
CERCLA/SARA - Section 313 - Emission Reporting	TOLUENE	108-88-3
CERCLA/SARA - Section 313 - Emission Reporting	XYLENE	1330-20-7
CWA (Clean Water Act) - Hazardous Substances	BENZENE	71-43-2
CWA (Clean Water Act) - Hazardous Substances	CYCLOHEXANE	110-82-7
CWA (Clean Water Act) - Hazardous Substances	ETHYL BENZENE	100-41-4
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CWA (Clean Water Act) - Priority Pollutants	ETHYL BENZENE	100-41-4
CWA (Clean Water Act) - Priority Pollutants	NAPHTHALENE	91-20-3
CWA (Clean Water Act) - Priority Pollutants	TOLUENE	108-88-3



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 15 Regulatory Information (continued)

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CWA (Clean Water Act) - Toxic Pollutants	ETHYL BENZENE	100-41-4
CWA (Clean Water Act) - Toxic Pollutants	NAPHTHALENE	91-20-3
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IARC - Group 2B (Possibly carcinogenic to humans)	ETHYL BENZENE	100-41-4
IARC - Group 2B (Possibly carcinogenic to humans)	LIGHT PETROLEUM DISTILLATE	8006-61-9
IARC - Group 2B (Possibly carcinogenic to humans)	NAPHTHALENE	91-20-3
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IARC - Group 3 (not classifiable)	XYLENE	1330-20-7
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Inventory - Canada - Domestic Substances List	BENZENE	71-43-2
Inventory - Canada - Domestic Substances List	CUMENE	98-82-8
Inventory - Canada - Domestic Substances List	CYCLOHEXANE	110-82-7
Inventory - Canada - Domestic Substances List	ETHYL BENZENE	100-41-4
Inventory - Canada - Domestic Substances List	LIGHT PETROLEUM DISTILLATE	8006-61-9
Inventory - Canada - Domestic Substances List	N-HEXANE	110-54-3
Inventory - Canada - Domestic Substances List	NAPHTHALENE	91-20-3
Inventory - Canada - Domestic Substances List	TOLUENE	108-88-3
Inventory - Canada - Domestic Substances List	XYLENE	1330-20-7
Inventory - TSCA - Sect. 8(b) Inventory	1,2,4-TRIMETHYLBENZENE	95-63-6
Inventory - TSCA - Sect. 8(b) Inventory	BENZENE	71-43-2
Inventory - TSCA - Sect. 8(b) Inventory	CUMENE	98-82-8
Inventory - TSCA - Sect. 8(b) Inventory	CYCLOHEXANE	110-82-7
Inventory - TSCA - Sect. 8(b) Inventory	ETHYL BENZENE	100-41-4
Inventory - TSCA - Sect. 8(b) Inventory	LIGHT PETROLEUM DISTILLATE	8006-61-9
Inventory - TSCA - Sect. 8(b) Inventory	N-HEXANE	110-54-3
Inventory - TSCA - Sect. 8(b) Inventory	NAPHTHALENE	91-20-3
Inventory - TSCA - Sect. 8(b) Inventory	TOLUENE	108-88-3
Inventory - TSCA - Sect. 8(b) Inventory	XYLENE	1330-20-7
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OSHA - Final PELs - Time Weighted Averages	BENZENE	71-43-2
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OSHA - Final PELs - Time Weighted Averages	CYCLOHEXANE	110-82-7
OSHA - Final PELs - Time Weighted Averages	ETHYL BENZENE	100-41-4
OSHA - Final PELs - Time Weighted Averages	N-HEXANE	110-54-3
OSHA - Final PELs - Time Weighted Averages	NAPHTHALENE	91-20-3
OSHA - Final PELs - Time Weighted Averages	TOLUENE	108-88-3
OSHA - Final PELs - Time Weighted Averages	XYLENE	1330-20-7
OSHA - Regulated Carcinogens	BENZENE	71-43-2
OSHA - Select Carcinogens	BENZENE	71-43-2
Pennsylvania - RTK (Right to Know) List	1,2,4-TRIMETHYLBENZENE	95-63-6
Pennsylvania - RTK (Right to Know) List	BENZENE	71-43-2
Pennsylvania - RTK (Right to Know) List	CUMENE	98-82-8
Pennsylvania - RTK (Right to Know) List	CYCLOHEXANE	110-82-7



Material Safety Data Sheet

REGULAR UNLEADED GASOLINE

Section 15 Regulatory Information (continued)

Pennsylvania - RTK (Right to Know) List	THYL BENZENE	100-41-4
Pennsylvania - RTK (Right to Know) List	N-HEXANE	110-54-3
Pennsylvania - RTK (Right to Know) List	NAPHTHALENE	91-20-3
Pennsylvania - RTK (Right to Know) List	TOLUENE	108-88-3
Pennsylvania - RTK (Right to Know) List	XYLENE	1330-20-7
Pennsylvania - RTK - Special Hazardous Substances	BENZENE	71-43-2
TSCA - Sect. 12(b) - Export Notification	CYCLOHEXANE	110-82-7
TSCA - Sect. 12(b) - Export Notification	N-HEXANE	110-54-3
TSCA - Section 8(a) - PAIR Reporting List	NAPHTHALENE	91-20-3

Section 16 Other Information

Precautionary labeling for pumps, portable containers, and drums is required. A "hazardous when empty" pictogram and D.O.T. flammable liquid label are also required for drums. Details available upon request. Because benzene is present in this product above 0.1%, the OSHA Standard for benzene is applicable to work locations upstream of final discharge from terminals. Consult 29CFR1910.1028 for details. Prolonged and repeated excessive exposures to benzene can result in blood disorders ranging from anemia to leukemia. Sun recommends that exposures to benzene be kept below 1.0 ppm for 8-hours; 5.0 ppm for 15-min. Normal service station operations are below these values. For use as motor fuel only. Do not use for any other purpose. Catecholamines and similar adrenergic drugs are generally contraindicated because of potential for increased sensitivity of the heart from hydrocarbon overexposure and subsequent ventricular fibrillation. EKG monitoring may be indicated and bronchodilators should be selected with care. Following injection, prompt debridement of the wound is necessary to minimize necrosis and tissue loss. COMPONENT TOXICITY: Overexposure to naphthalene, a minor component of this product, may cause skin, eye and respiratory tract irritation, anemia, loss of vision, nervous system effects and kidney and thymus damage. Also, exposure to naphthalene has produced "respiratory tract" tumors in laboratory animals.

Preparation Date of Material Safety Data Sheet

DATE PREPARED..... 03/06/96
 REVISION DATE 08/20/04

DISCLAIMER: Information presented herein has been compiled from information provided to us by our suppliers and other sources considered to be dependable and is accurate and reliable to the best of our knowledge and belief but is not guaranteed to be so. Nothing here in is to be construed as recommending any practice or the use of any product in violation of any patent or in violation of any law or regulation. It is the users' responsibility to determine the suitability of any material for a specific purpose and to adopt such safety precautions as may be necessary. We make no warranty as to the results to be obtained by using any material and since conditions of use are not under our control, we must necessarily disclaim all liability with respect to the use of material supplied by us.

11/26/2014

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE - Pre-existing skin disorders
NOTES TO PHYSICIAN - None

***** VI. REACTIVITY DATA *****

STABILITY - Stable
CONDITIONS TO AVOID - None known
INCOMPATIBILITY (Materials to Avoid) - Strong Oxidizers
HAZARDOUS DECOMPOSITION PRODUCTS - Carbon Monoxide, Sulfur Oxides and Oxides of Phosphorus in case of incomplete combustion.
HAZARDOUS POLYMERIZATION - Will not occur

***** VII. PRECAUTIONS FOR SAFE HANDLING AND USE *****

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED - Recover free liquid. Add absorbent to spill area, then pick up and place in disposal containers. Keep petroleum products out of sewers and water courses by diking or impounding.
WASTE DISPOSAL METHOD - Federal, State and/or Local approved disposal for waste oils.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE - Keep containers closed when not in use. Do not store at temperatures above 140°F (60°C). Avoid breathing oil mist.
OTHER PRECAUTIONS - None

***** VIII. CONTROL MEASURES *****

RESPIRATORY PROTECTION - Not normally required
VENTILATION - As needed to keep exposure levels below the TLV
PROTECTIVE GLOVES - Not normally required
EYE PROTECTION - Goggles or shielded safety glasses if subject to splashing
OTHER PROTECTIVE EQUIPMENT - Not normally required
WORK/HYGIENIC PRACTICES - Observe good personal hygiene practice when handling this material. Remove oil-soaked clothing and launder before reusing. Discard oil-soaked shoes.

***** IX. TRANSPORTATION DATA *****

DOT SHIPPING NAME - N/A DOT HAZARD CLASS - N/A
UN/NA NUMBER - N/A DOT LABEL(S) - N/A
FREIGHT CLASSIFICATION - Petroleum, lubricating oil (NMFC 155250 SUB 2 CLASS 65)

* * * * *

FOR ADDITIONAL INFORMATION CONTACT: Regulatory Affairs Office
(800) 827-0711 Ext. 277

* * * * *

THIS INFORMATION IS BEING SUPPLIED TO YOU UNDER OSHA "RIGHT TO KNOW" REGULATION 29 CFR 1910.1200 AND IS OFFERED IN GOOD FAITH. THE INFORMATION CONTAINED HEREIN IS BASED ON THE DATA AVAILABLE TO US AND IS BELIEVED TO BE TRUE AND ACCURATE. NO WARRANTY, EXPRESSED OR IMPLIED, REGARDING THE ACCURACY OF THIS DATA, THE HAZARDS CONNECTED WITH THE USE OF THE MATERIAL, OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF, IS MADE. TEXAS REFINERY CORP. ASSUMES NO RESPONSIBILITY FOR DAMAGE OR INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN.

11/26/2014

inhalation, remove to fresh air. For ingestion, obtain medical advice.
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE - Pre-existing skin disorders
NOTES TO PHYSICIAN - None

***** VI. REACTIVITY DATA *****

STABILITY - Stable
CONDITIONS TO AVOID - None known
INCOMPATIBILITY (Materials to Avoid) - Strong Oxidizers
HAZARDOUS DECOMPOSITION PRODUCTS - Carbon Monoxide, Sulfur Oxides & Oxides of Phosphorus in case of incomplete combustion
HAZARDOUS POLYMERIZATION - Will not occur

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STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED - Recover free liquid. Add absorbent to spill area, then pick up and place in disposal containers. Keep petroleum products out of sewers and water courses by diking or impounding.
WASTE DISPOSAL METHOD - Federal, State and/or Local approved disposal for waste oils
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE - Keep containers closed when not in use. Do not store at temperatures above 140°F (60°C). Avoid breathing oil mist.
OTHER PRECAUTIONS - None

***** VIII. CONTROL MEASURES *****

RESPIRATORY PROTECTION - Not normally required
VENTILATION - As needed to keep exposure levels below the TLV
PROTECTIVE GLOVES - Not normally required
EYE PROTECTION - Goggles or safety glasses with side shields if subject to splashing
OTHER PROTECTIVE EQUIPMENT - Not normally required
WORK/HYGIENIC PRACTICES - Observe good personal hygiene practice when handling this material. Remove oil-soaked clothing and launder before reusing. Discard oil soaked shoes.

***** IX. TRANSPORTATION DATA *****

DOT SHIPPING NAME - N/A DOT HAZARD CLASS - N/A
UN/NA NUMBER - N/A DOT LABEL(S) - N/A
FREIGHT CLASSIFICATION - Petroleum, lubricating oil (NMFC 155250 SUB 2 CLASS 65)

* * * * *

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Technical Questions - ACI Concrete Knowledge Center

Limits on free fall of concrete

Q. Is there a maximum acceptable free-fall distance for concrete placement?

A. The American Concrete Institute's two main standards governing building construction, ACI 318-05 and 301-05, don't directly address the issue of free fall of concrete. Other ACI documents currently provide the following information on the free fall of concrete:

Section 5.4.1 of ACI 304R-00, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," cautions:

"Arrange equipment so that the concrete has an unrestricted vertical drop to the point of placement or into the container receiving it. The stream of concrete should not be separated by falling freely over rods, spacers, reinforcement, or other embedded materials. If forms are sufficiently open and clear so that the concrete is not disturbed in a vertical fall into place, direct discharge without the use of hoppers, trunks or chutes is favorable. Concrete should be deposited at or near its final position because it tends to segregate when it has to be flowed laterally into place."

Section 3.5.6 of ACI 336.1-01, "Specification for the Construction of Drilled Piers," cautions:

"Guide placement of free-fall concrete so as not to hit the reinforcement, hole sides, or anchor bolt assemblies. Vibration of concrete free falling more than 20 ft is not required."

In the Specification's Notes to Owner's Representative, ACI 336.1-01 has two other pieces of information:

1. If some pier diameters are less than 30 in. (750 mm), review the Specification and modify. If pier diameters are less than 30 in. (750 mm), certain elements of the Specification can be inappropriate, such as the permitted use of free-fall concrete and any requirements for physical downhole inspection. The risk of free-fall concrete scraping the sides of the shaft while falling increases dramatically as the shaft diameter decreases below 30 in. (750 mm), and physical bottom inspection of pier diameters less than 30 in. (750 mm) is impractical.
2. Specify if free-fall concrete is not permitted or if the free-fall height is limited. Recent research on free-fall concrete has confirmed that free fall does not cause segregation, at least for fall heights up to 60 ft (18 m) and pier diameters as small as 3 ft (1 m) with 10 in. (750 mm) diameter cages. Even accidentally hitting the reinforcing bar cage does not appear to result in measurable segregation (ADSC-FHWA report on "The Effects of Free-Fall Concrete in Drilled Shafts," [1994]); however, hitting the reinforcing bar cage may displace the cage and should be avoided. Thus, free-fall limits may be desirable in small diameter shafts deeper than 60 ft (18 m).

ACI 336.3R-93, "Design and Construction of Drilled Piers," states:

"It is also permissible to allow free fall of concrete as long as it can be directed vertically on the centerline of the shaft, and it does not hit the sides of the shaft or the reinforcement cage."

In the June 2001 issue of ACI's magazine, *Concrete International*, an article by Suprenant cites several references summarizing the effects of free fall. He concludes that free fall of concrete directly over reinforcing bar or at high slumps doesn't cause segregation or reduce compressive strength, but restricting free-fall height does decrease concrete production rates and increase owner costs.

The article may be found at the following link:

http://www.concreteinternational.com/pages/featured_article.asp?ID=10274

ACI members can access this article for free once 'registered' and 'logged in' to the ACI website. Non members can read the abstract and have the option to purchase the article.

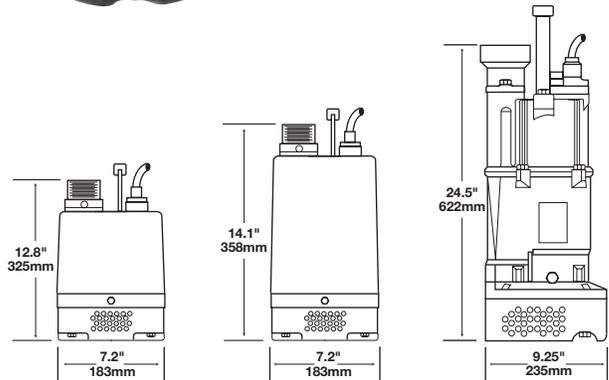
To purchase ACI committee documents referenced above, visit the bookstore at:

<http://www.concrete.org/bookstorenet/>

FAQ posted February 16, 2006.

GSP05/10/20 Sub-Prime® Electric Submersible Pumps

The GSP Sub-Prime line is a selection of portable, electric submersible dewatering pumps available for a wide range of pumping applications on construction, industrial, mining, utility, and municipal job sites. Available in 0.5 hp / 0.4 kW (GSP05), 1 hp / 0.75 kW (GSP10), and 2 hp / 1.5 kW (GSP20) models, the GSP Sub-Prime offers flow rates from 70 through 110 gpm (4.4 through 6.9 l/sec) and maximum heads from 39 to 70 feet (11.9 to 21.3 meters). Compact design allows these versatile units to go where other pumps simply would not fit. An optional piggy back single float switch can be supplied as a cost-effective choice for applications requiring automatic operation.



Features

- UL listed & approved *
- Dry running capability without damage
- No control panel required for starting. (Control panel is required for motor protection.)
- Portable, lightweight, durable
- Slim line top discharge design, only 7.2" (183mm) diameter for 0.5 and 1 hp (0.4 and 0.75 kW) models, 9.25" (235mm) diameter for 2 hp (1.5 kW) model
- Non-wicking cable with strain relief
- High-torque, capacitor-start motor
- Motor thermal overload protection
- Outer jacket for continuous cooling of motor
- Silicon Carbide upper and lower mechanical seals
- Triple seals — internal upper & lower mechanical seals and external lip seal
- Torque flow impeller

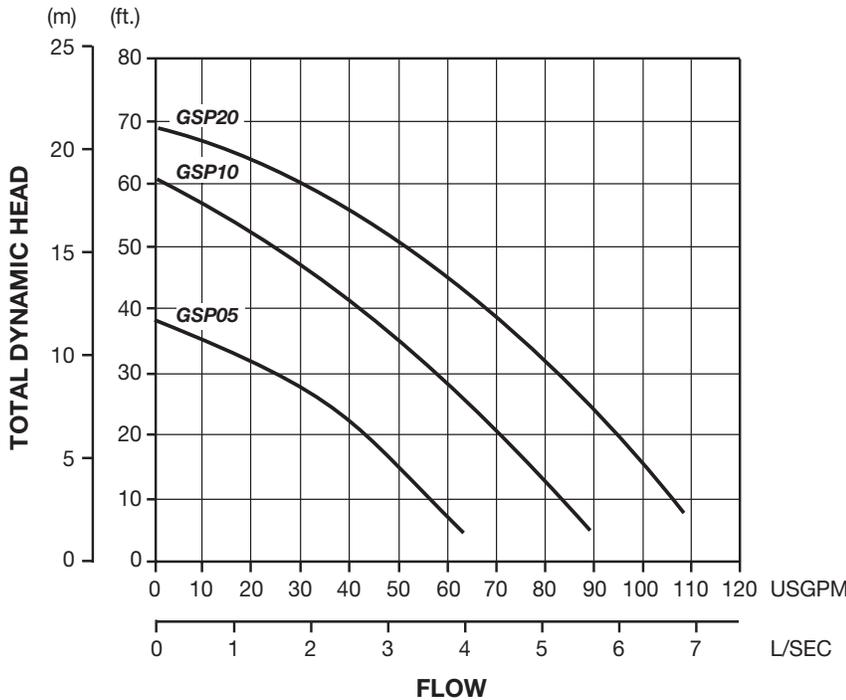
Specifications

	GSP05	GSP10	GSP20†
HP/kW	0.5 HP/0.4 kW	1.0 HP/.75 kW	2.0 HP/1.5 kW
Max. Flow	70 gpm (4.4 l/sec)	90 gpm (5.7 l/sec)	110 gpm (6.9 l/sec)
Max. Head	39' (11.9M)	60' (18.3M)	70' (21.3M)
Max. Solids	1/3" (9mm)	1/3" (9mm)	1/3" (9mm)
Cable Length	30' (9M)	50' (15M)	50' (15M)
Discharge Size	2" (50mm)	2" (50mm)	3" (75mm)
RPM	3600	3600	3600
Max. Fluid Temp.	90° F (32° C)	90° F (32° C)	104° F (40° C)
PH Range	6.5-8.0	6.5-8.0	6.5-8.0
Voltage	115, 230	115, 230	115/230
Amps	5.8, 3.2	10.3, 5.11	25.9/13.0
Phase	Single	Single	Single
Height	12.8" (325mm)	14.1" (358mm)	24.5" (622mm)
Width	7.2" (183mm)	7.2" (183mm)	9.25" (235mm)
Weight	20 lbs. (9 kg.)	29 lbs. (13 kg.)	61 lbs. (28 kg.)
Max. Sub.	16.5' (5M)	16.5' (5M)	16.5' (5M)

* n.a. for GSP20
†GSP20 CSA certification pending.

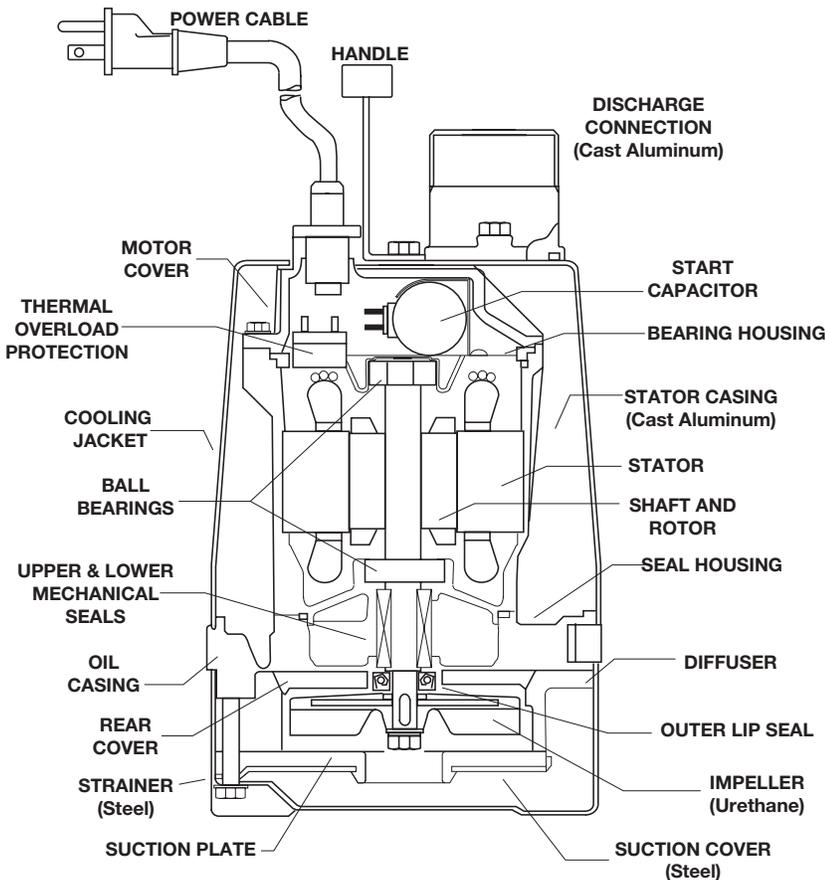


GSP Sub-Prime® Performance Curves



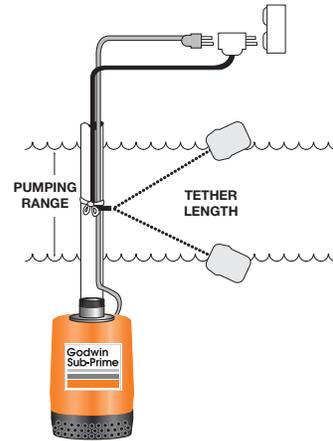
WARNING: Pumps are not designed for use in explosive atmosphere, flammable environments or for pumping volatile liquids.

Design & Construction



Float Switch

Optional Float Switches available for automatic, remote activation of Sub-Prime pumps. Package consists of 30'/50' (9M/15M) power cord with piggy-back power plug, variable length float tether, and sealed float. Typical configuration shown in the following.



Pumping range determined by tether length according to the following guide.

Tether Length	3.5	5	7	9	11	13	15	(in.)
	89	127	178	229	279	330	381	(mm)
Pumping Range	6.5	7.5	8.5	10	11	12.5	13.5	(in.)
	165	191	216	254	279	318	343	(mm)

Pumping range based on operation in non-turbulent conditions. Actual range may vary due to temperature conditions and cord shape. Tether length increases variance of pumping range.



†GSP20 CSA certification pending.

godwin pumps

One Floodgate Road, Bridgeport, NJ 08014, USA
(856) 467-3636 • Fax: (856) 467-4841
Quenington, Cirencester, Glos., GL7 5BX, UK
+44 (0)1285 750271 • Fax: +44 (0)1285 750352

E-mail: sales@godwinpumps.com
www.godwinpumps.com

BRANCH LOCATIONS:

Connecticut • Pennsylvania • New York • Ohio
Illinois • Maryland • Virginia • West Virginia
Georgia • South Carolina • North Carolina
Florida • Texas • Montana • California • Washington

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Godwin Wet-Prime



GDP-80HX



GPL-50HX



GWP-25HX



GPP-50HX



GTP-100HX



GWP80-HX

Portable, gasoline-powered Wet-Prime pumps from the people who understand your pumping needs.



Think Orange. Think Godwin.
Great Pumps. Great People.

www.godwinpumps.com

Dewatering Pumps

Semi-Trash

GWP-25HX

GWP-50HX

GWP-80HX

GWP-100HX

The right pumps for:

- ▶ Pumping water with light abrasives & small solids, **semi-trash**
- ▶ Construction & industrial dewatering
- ▶ Landscaping & irrigation
- ▶ Utilities, manholes & vault draining



Discharge Dia. - " (mm)	1 (25)	2 (50)	3 (80)	4 (100)
Solids Handling Dia. - " (mm)	0.2 (5)	0.75 (19)	0.75 (19)	0.75 (19)
Max. Head - ' (m)	106 (32)	95 (29)	85 (26)	92 (28)
Max. Flow - GPM (m ³ /h)	30 (6.9)	158 (36)	238 (54)	383 (87)
Power - HP (kW)	1.1 (0.8)	4.0 (3)	5.5 (4.1)	8.0 (5.9)
Fuel Tank Cap. - gal. (l)	0.15 (0.55)	0.66 (2.5)	0.95 (3.6)	1.58 (6)
Weight - lbs. (kg)	12.1 (5.5)	51 (23)	64 (29)	123 (56)

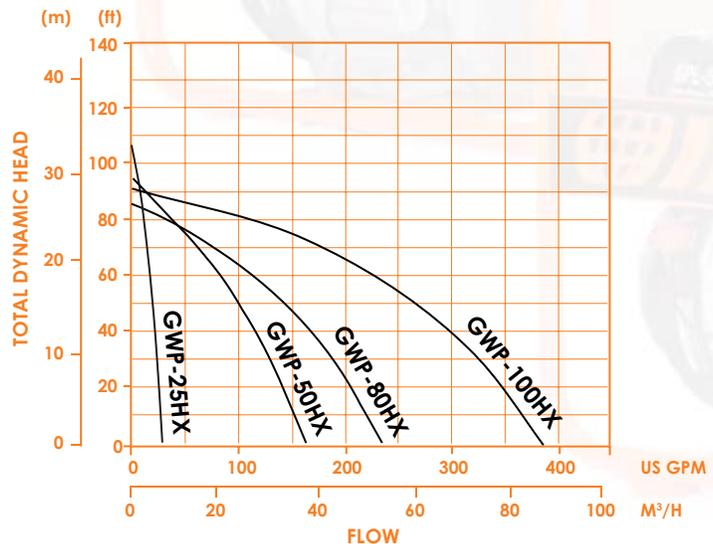
Features & Benefits

GWP-25HX

- ▶ Carbon ceramic mechanical seal for increased protection
- ▶ Die-cast aluminum volute & impeller
- ▶ Lightweight die-cast aluminum pump casing
- ▶ High efficiency, four-stroke engine

GWP-50HX, GWP-80HX & GWP-100HX

- ▶ **Semi-trash** handling capability
- ▶ Abrasion resistant solid silicon carbide mechanical seal for superior durability
- ▶ High-grade ductile iron volute & impeller for reduced wear & maintenance
- ▶ Removable, lightweight die-cast aluminum pump casing
- ▶ Durable, lightweight steel roll cage for added protection & easy maneuvering
- ▶ High performance engine with Oil Alert® system & electronic ignition to increase fuel efficiency
- ▶ Rubber mounts for reduced vibration



Trash Pumps

GTP-50HX

GTP-80HX

GTP-100HX

The right pumps for:

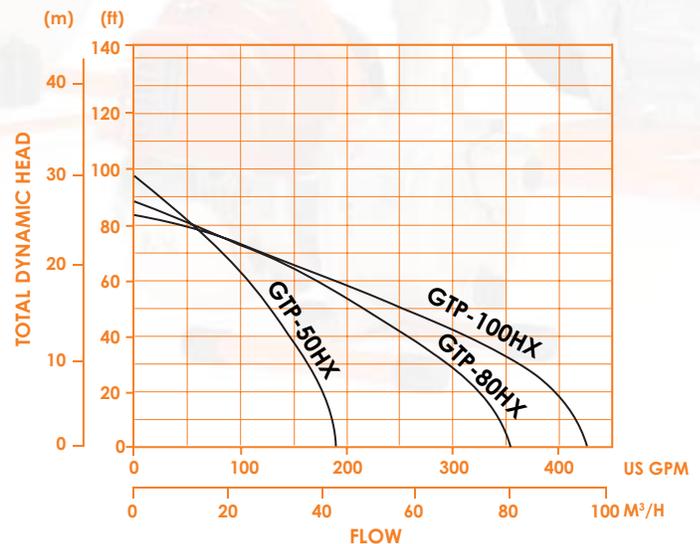
- ▶ Construction & industrial, trash-laden water
- ▶ Stream/pond dewatering
- ▶ Septic tanks & manholes
- ▶ Pumping water with light abrasives & solids



Discharge Dia. - " (mm)	2 (50)	3 (80)	4 (100)
Solids Handling Dia. - " (mm)	1 (25)	1.5 (38)	2 (50)
Max. Head - ' (m)	98 (30)	89 (27)	82 (25)
Max. Flow - GPM (m ³ /h)	185 (42)	354 (80)	425 (96)
Power - HP (kW)	5.5 (4.1)	8.0 (6)	11.0 (8.2)
Fuel Tank Cap. - gal. (l)	0.95 (3.6)	1.58 (6)	1.72 (6.5)
Weight - lbs. (kg)	104 (47)	128 (58)	172 (78)

Features & Benefits

- ▶ Solids handling capability
- ▶ Abrasion resistant solid silicon carbide mechanical seal for superior durability & protection
- ▶ High-grade ductile iron volute & wearplate for reduced wear & maintenance
- ▶ Hi-chrome cast iron impeller for reduced wear & maintenance
- ▶ Removable, lightweight die-cast aluminum cover & volute for fast debris removal
- ▶ Durable, lightweight steel roll cage for added protection & easy maneuvering
- ▶ High performance engine with Oil Alert system & electronic ignition to increase fuel efficiency
- ▶ Rubber engine mounts for reduced vibration

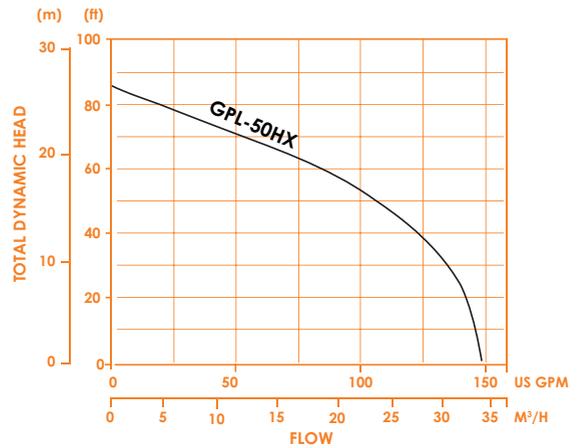


Plastic Pump

GPL-50HX

The right pump for:

- ▶ Agricultural chemicals
- ▶ General dewatering
- ▶ Landscaping
- ▶ Irrigation
- ▶ Saltwater dewatering
- ▶ Swimming pools



Features & Benefits

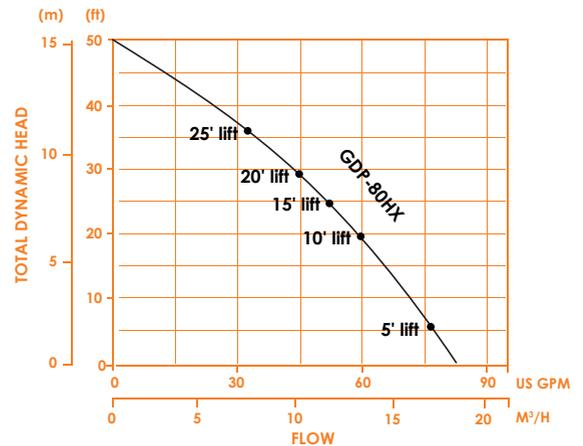
- ▶ Lightweight, thermoplastic construction resists light chemicals & corrosion
- ▶ Carbon ceramic seals with EPDM elastomers for increased protection
- ▶ Thermoplastic volute & impeller for increased portability & chemical resistance
- ▶ Durable, lightweight steel roll cage for added protection & easy maneuvering
- ▶ High performance engine with Oil Alert system & electronic ignition to increase fuel efficiency

Diaphragm Pump

GDP-80HX

The right pump for:

- ▶ Construction dewatering
- ▶ Mud, sand & sludge
- ▶ Utility dewatering
- ▶ Limited wellpointing



Features & Benefits

- ▶ Large solids handling capability
- ▶ Dry running
- ▶ Easy-priming positive displacement design
- ▶ Easily replaced neoprene rubber elastomer diaphragm and nitrile (Buna-N) flapper valves
- ▶ Portable, lightweight aluminum casing

Discharge Dia. - " (mm)	2 (50)
Solids Handling Dia. - " (mm)	0.12 (3)
Max. Head - ' (m)	85 (26)
Max. Flow - GPM (m³/h)	148 (34)
Power - HP (kW)	4.0 (3.0)
Fuel Tank Cap. - gal. (l)	0.45 (1.7)
Weight - lbs. (kg)	46 (21)

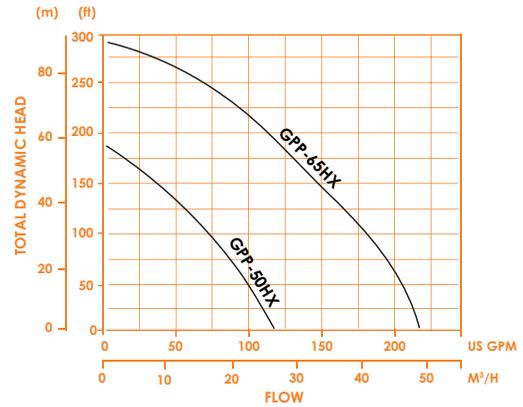
Discharge Dia. - " (mm)	3 (80)
Solids Handling Dia. - " (mm)	2 (50)
Max. Head - ' (m)	50 (15.2)
Max. Flow - GPM (m³/h)	80 (18)
Power - HP (kW)	5.5 (4.0)
Fuel Tank Cap. - gal. (l)	0.95 (3.6)
Weight - lbs. (kg)	135 (61.2)

Pressure Pumps

GPP-50HX GPP-65HX

The right pump for:

- ▶ Marine construction
- ▶ Remote firefighting
- ▶ Landscaping
- ▶ Irrigation
- ▶ Tank cleaning
- ▶ Jetting



Discharge Dia. - " (mm)	2 (50)	2.5 (65)
Solids Handling Dia. - " (mm)	0.12 (3)	0.375 (9.5)
Max. Head - ' (m)	187 (57)	285 (87)
Max. Flow - GPM (m³/h)	116 (26)	218 (49)
Power - HP (kW)	5.5 (4.1)	13 (9.7)
Fuel Tank Cap. - gal. (l)	0.95 (3.6)	1.73 (6.5)
Weight - lbs. (kg)	71 (32)	128 (58)

Features & Benefits

- ▶ Carbon ceramic seals for increased durability & shaft/seal protection
- ▶ GPP-50HX: Cast iron volute & impeller; GPP-65HX: Aluminum volute & impeller
- ▶ Durable, lightweight steel roll cage for added protection & easy maneuvering
- ▶ High performance engine with Oil Alert system & electronic ignition to increase fuel efficiency
- ▶ GPP-65HX features exhaust-driven venturi for automatic priming

Parts & Accessories

Godwin Pumps has built its reputation on reliability. Our parts and service are available to meet your pumping emergencies whenever and wherever they occur.



Our parts inventory includes a full range of replacement parts for each of the pumps we sell. In addition, we stock a variety of suction and discharge hoses and couplings to complete your pumping application needs.

Our service and support include 24/7 on-site service and repair, engineering specialists to tailor pumping solutions specific to your needs and a comprehensive parts and service facility.



Wet-Prime Pumps

Godwin Pumps is pleased to introduce its new line of portable, gasoline-powered Wet-Prime pumps. Available in dewatering, trash, plastic and pressure models with both Honda® and Subaru Robin® engines, Godwin Wet-Prime pumps are capable of maximum heads to 285' and maximum flows to 425 GPM. Ideal for applications including construction dewatering, landscaping and irrigation, farming, remote firefighting and marine construction, the Wet-Prime series is backed by the same dependable parts and service availability as Godwin's Dri-Prime®, Heidra® and Sub-Prime® pumps.

Reliable. Reputable. Responsive.

Think Orange. Think Godwin. Great Pumps. Great People.



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ChemMasters

Installation Guidelines

CreteLox is a non-reemulsifiable, acrylic latex bonding agent and admixture. This high performance polymer is formulated as a bonding agent for cementitious mortars and toppings and as an admixture to site mixed or prepackaged cement based mortars.

1.0 General

1.1 Scope

This specification covers the performance characteristics and application procedures for providing a non-reemulsifiable, acrylic latex bonding agent and admixture. This high performance polymer is formulated as a bonding agent for cementitious mortars and toppings and as an admixture to site mixed or prepackaged cement based mortars.

1.2 Material Description

The material shall be a non-reemulsifiable, acrylic latex bonding agent and admixture that forms a permanent, positive chemical and mechanical bond to sound surfaces which may be used alone or as a slurry bond coat. As an admixture, it should increase abrasion and impact resistance with early and ultimate flexural, tensile and compressive strengths, improve chemical resistance to fertilizers, acids, and alkalis, and significantly prohibit chloride ion penetration increasing corrosion resistance of reinforcing steel.

1.3 Typical Applications

- A. Interior or exterior, above or below grade bonding agent
- B. Performance enhancing admixture for stucco, cement plaster, cementitious toppings and overlays, prepackaged and site mixed mortars
- C. Cyclically damp environments, food processing plants, water storage facilities, swimming pools
- D. Polymer modified concrete ((PMC) for bridge decks and white toppings

1.4 Limitations

- A. Do not use air entraining admixtures or cements or other admixtures.
- B. Do not apply when the surface or air temperature is, or is expected to go, below 45° F./6° C. Do not apply to frozen or frost filled surfaces.
- C. Overworking or over trowelling surface may cause blisters or delaminations.
- D. Do not seal surface with solvent based products. Organic solvents of high solvency power, xylene, toluene, lacquer thinner, etc., will soften surface if spills are not removed quickly.

1.5 Quality Assurance

The repair contractor shall have experience and proficiency specific to the repair type and shall be approved by the engineer and the material supplier. The material supplier shall provide job service as required to assure proper handling and installation of materials. The field representative shall instruct as needed to assure that handling, mixing, placing and finishing of materials are in accordance with specifications.

1.6 Delivery, Storage and Handling

The product shall be delivered in the original, unopened containers. It shall be labeled with the manufacturer's name, product name and lot number. Materials should be stored at the job site under dry conditions and at a temperature of 40° F., (4° C.) to 90° F. (32° C.).

1.7 Environmental Requirements

All materials used for the repair work shall be VOC compliant. The manufacturer shall supply the appropriate material safety data sheets upon request.

1.8 Site Conditions

A. Coverage is dependent upon surface texture and porosity.

2.0 Materials

2.1 Approved Materials and Manufacturers

2.1.1 Product Standard

CreteLox, as manufactured by ChemMasters, 300 Edwards Street, Madison, Ohio, 44057-3112, 1-800-486-7866, is considered to conform to the requirements of this specification and shall be the bonding agent or admixture used. Cretelox is a non-reemulsifiable, acrylic latex bonding agent and admixture. This high performance polymer is formulated as a bonding agent for cementitious mortars and toppings and as an admixture to site mixed or prepackaged cement based mortars.

2.1.2 Substitutions

No submittals for substitutions will be accepted after the bid date. All submittals must be made in writing to the engineer with supporting technical data sheets and test data showing complete equivalent performance.

2.2 Packaging/Coverage/Estimating

2.2.1 Packaging

Cretelox is packaged in 55 U.S. gallon /208 Liter drums and 5 gallon/18.9 Liter pails, shipped 36 pails per pallet, shrink wrapped and in 1 gallon/3.8 liter plastic jugs, packed 4 per case.

2.2.2 Estimating and Coverage

Coverage is affected by texture or porosity of substrate.

Ft.²/gallon M²/Liter

A. Bonding Agent 200-250 5-6

B. Slurry Bond Coat 400-500 10-12

C. Admixture normally 30% to 50% of standard water requirement

2.3 Storage:

Store tightly sealed containers at room temperature. Keep from freezing. If Cretelox freezes, allow it to thaw normally at room temperature. Shelf life of properly stored material is one year from date of manufacture.

2.4 Engineering Properties

Physical Properties of Modified Portland Cement Mortar

2.4.2.1 Hardness Properties

Test Method % Improvement Curing Method: Moist Dry

2.4.1.1 Shear Bond Strength (ASTM C-1042): 389% 1600%

2.4.1.2 Flexural Strength (ASTM C-348) 127% 222%

2.4.1.3 Tensile Strength (ASTM C-190) 21% 215%

2.4.1.4 Tensile Strength (ASTM C-190) 121% 215%

2.4.1.5 Compressive Strength (ASTM C-109) 94% 228%

2.4.1.6 Abrasion Resistance Taber: 298% 1400%

Comparisons are 3:1 sand/cement mortar cured 28 days.

Cretelox modified mortar was dry cured.

2.5 Accessory Materials as manufactured by ChemMasters, 300 Edwards Street, Madison, Ohio, 44057-3112, 1-800-486-7866, is considered to conform to the requirements of this specification.

3.0 Execution

3.1 References

A. Meets the requirements of ASTM C-1059, Type II, Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete when tested in accordance with ASTM C-1042.

B. Refer to ChemMasters MSDS and Technical Data Sheets

3.2 Surface Preparation:

Substrate to be repaired or topped must be clean and free of all dust, dirt, oil, grease, curing or sealing compounds or other contaminants that may interfere with proper adhesion. If ambient temperatures are above freezing, saturate prepared surface with water. Remove any puddles.

3.2 Mixing:

A. Mixing Cretelox before using. If Cretelox is to be diluted for use as an admixture, blend Cretelox with water then add dry mix.

B. Slurry bond coat requires: 2 gal./7.6 L water 2 gal./7.6 L Cretelox 94 lb. 42.6 Kg cement 50 lb./22.7 Kg sand or 50% water/50% Cretelox and measured amount of dry, packaged mortar to achieve batter consistency

C. As admixture in packaged or site mix mortars, use Cretelox to replace 50% to 100% of the normal water required.

D. Cement based masonry coatings or other thin mortars and toppings may be mixed with Cretelox alone for optimum adhesion and durability.

E. Do not mix more material than can be placed in 20 minutes. Do not over mix as this results in excessive air entrainment and loss of strength. Particular care should be taken when power mixing, 1-2 minutes maximum.

3.3 Bonding Agent Application: Apply Cretelox at a rate of 200-250 Ft.² per gallon/5-6 M² per liter with a garden type sprayer or solvent resistant roller. Place fresh concrete or mortar while Cretelox is wet.

3.4 Bonding Slurry Application: (Preferred method) Slurry should have the consistency of pancake batter. Apply to substrate with a stiff bristle brush, working bond coat into voids, cracks and corners. Place repair mortar or topping while slurry is wet or damp.

3.5 Horizontal Repairs: Replace 50% of the normal water with Cretelox. Mix and place as usual. Over working or over trowelling surface may cause blisters or peeling.

3.6 Vertical and Overhead Repairs: Replace 50%-75% of the normal water with Cretelox. Place as usual. Best results are obtained if repairs are made in 0.5 inch/1.25 cm lifts. A stiff mix is easier to place.

3.7 Cement Plaster Ceilings: Use Cretelox alone. Build up in thin coats of .25 inch/.62 cm but do not exceed 0.5 inch/1.25 cm in depth.

3.8 Curing:

- A. Cretelox modified concrete and mortar is self curing under normal conditions. Do not use curing compounds on Cretelox modified mortars or toppings. In extremely hot, dry or windy environments, keep repair area damp with wet burlap for 24 hours.
- B. Cretelox requires at least 3 consecutive days of normal drying conditions during the curing cycle. If Cretelox is used in damp or confined areas, supplemental ventilation may be necessary to facilitate full curing and drying.

Shore Pac[®] Polymer Slurry Drilling Process

Definition and Formulations

Shore Pac is not a hazardous waste, nor does it pose any threat to waters when disposed of according to manufacturer's guidelines.

Shore Pac is approved for use by The Federal Highway Administration, (FHWA) and is used in State Departments of Transportation throughout the nation. The method for disposing the drilling slurry Shore Pac on Drilled Shaft Projects has been listed within this website.

Shore Pac is a dry granular synthetic anionic polyacrylamide. Shore Pac is manufactured from co-polymerization of acrylimide and acrylic acid or its inorganic salts. The molecular weight (in the region of several million Daltons) and negative charge density varies (by variation of the ratio of acrylimide and acrylic acid monomer units).

In general the "polymer" used in Shore Pac is designated as non hazardous and is water soluble or water dispersible. The term polymer simply means – many parts, or is an organic chemical having a molecular weight above 200, with greater than eight repeating units. Polymers vary greatly in function and basic properties, such as stability, charge, and molecular weight. In general, polymers can be classified as natural, modified-natural, or synthetic. The term "monomer" simply means – a large molecule made up of simple repeating units. A polymer is a compound that consists of a chain of repeating base units, called monomers. Shore Pac is a synthetic polymer.

Shore Pac is a very high molecular weight synthetic polymer with negative charges on the backbone. Its high molecular weight gives viscosity to water at low concentrations.

When Shore Pac is dissolved in aqueous solution, the very long polymer chains dissolve and orient randomly in the fluid in coils. In fresh water, the repulsion of the negative charges on the backbone of the polymer chains causes the coils to expand and to occupy a large volume in the fluid. When the fluid is sheared, the expanded polymer chains are located in different fluid layers in the shear field. The uncoiling of these expanded polymer chains dissipates mechanical energy and results in viscosity.

The high molecular weight polymer chains are so long that different parts of individual polymer chains bridge different solid particles. It is this adsorption on surfaces and bridging of solid surfaces that makes this polymer effective in keeping solids consolidated while drilling a foundation. In addition, the adsorbed layer of hydrophilic polymer on rock surfaces slows down the diffusion of water into the rock.

Shore Pac[®] Quality Specifications

Quality Specifications for Slurries Based on Shore Pac[®]

Testing of the Shore Pac Slurry

1.) Marsh Funnel Viscosity (MFV)

This test requires both a Marsh Funnel and a Viscosity Cup. MFV is reported in seconds per quart. The time in seconds for a quart of slurry to pass through the funnel tip is reported as viscosity in seconds per quart. The MFV is very useful in determining the concentration of polymer molecules, and also its ability to stabilize surrounding soils.

2.) pH (potential hydrogen- ion)

Dipping a piece of litmus paper in the slurry and comparing the color change to a standard chart performs this test. The result of this test is reported in a number from 1 to 14. The range for maximum Shore Pac performance is 8-10. This is the level at which polymer molecules can fully hydrate and extend, creating more viscosity. Levels of pH below 6 (acidic) can affect the performance of the Shore Pac slurry and should be adjusted by adding soda ash (Na₂CO₃) @ 5 lb per 1000 gallons mix water. In addition the Soda Ash Carbonate (CO₃=) ion present in 8-10 pH solutions is useful in buffering the slurry against Calcium and Magnesium contamination.

3.) Density

This test is performed with a standard mud balance and is reported as specific gravity, pounds per cubic foot lb/ft³ or pounds per gallon. The lbs per ft³ of Shore Pac slurry should be approximately 64.0. The density may be slightly higher depending on the amount of fine soil particles mixed in the slurry. Shore Pac slurries have the same density as water, specific gravity 1.0 (± 0.05). If the density is outside of this range the Shore Pac polymer concentration could be to low. A viscosity test should be taken to check this.

4.) Sand Content

This test is performed with a standard sand content kit, and the results are reported as percent sand. This test is normally performed at the completion of an excavation and just prior to placing concrete. The sample to be tested should be taken from near the bottom of the excavation. When using Shore Pac slurries the sand content will rarely test over 1.0% sand. Due to its flocculating ability, it drops the sand very quickly and the slurry remains nearly sand free.

When performing the sand content test in the field the addition of hypochlorite (Slurry Buster) solution in place of water to dilute the slurry sample can prevent the accumulation of silt, which creates false sand reading in the test.

Shore Pac CETCO Drilling Products

PROPERTY	REQUIREMENT	TEST
Viscosity (seconds/quart)		
- during drilling	35 to 135	Marsh Funnel and Cup
- prior to final cleaning	less than or equal to 60	API 13 B-1
- just prior to placing concrete	less than or equal to 60	Section 2.2
pH	8.0-10.0	Glass Electrode pH Meter or pH Paper
Density (lb/ft ³)		Mud Weight (Density)
- during drilling	less than or equal to 64*	API 13 B-1
- just prior to placing concrete	less than or equal to 64*	Section 1
Sand Content (%)		Sand
- prior to final cleaning	less than or equal to 1.0%	API 13 B-1
- just prior to placing concrete	less than or equal to 1.0%	Section 5

*When approved by the engineer, slurry may be used in saltwater, and the allowable densities may be increased up to 2 pcf.

Slurry temperature shall be at least 4° Celsius (40° Fahrenheit) when tested.

Shore Pac® - Control Pressure and Stabilize Borehole

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Two types of pressure are exerted on the borehole during drilling, formation pressure and hydrostatic pressure. Formation pressure can collapse the borehole if it is not overcome by hydrostatic pressure pushing back against the formation. Hydrostatic pressure is the weight or density of the volume of drilling slurry pushing against the formation. In order to have hydrostatic pressure, the drilling slurry must push back against the formation with minimal penetration into the formation. In unconsolidated permeable formations, the hydrostatic pressure occurs when the weight of the fluid is in contact with the impermeable deposits (filter cake) placed on the sides of the borehole by the drilling slurry. The filter cake and the hydrostatic pressure thereby control the formation pressure, reduce slurry loss and prevent caving, resulting in hole stabilization.

Normal water weighs 8.34 lbs/gal, with the Shore Pac polymer fluid at 8.4 lbs/gal, it is necessary to maintain the slurry level 2 to 3 meters (7 to 10 feet) above the surrounding groundwater level. This 2 to 3 meters of hydrostatic pressure, or head, exerts the pressure necessary (approx. 450 to 640 lb/ft², or 2000 to 3000 kg/m²), to support the walls of the excavation and is required to assure hole stability. Without this positive pressure exerted by the slurry column against the sidewall, soil overburden pressures will cause the excavation to collapse. The natural soil overburden pressures forced against the positive pressure exerted by the slurry column result in little or no leach ability to the surrounding formation.

Recycling Shore Pac® Slurry

After the slurry testing has been completed and the rebar has been placed, a suction line should be dropped just inside the excavation for recycling of the slurry. While the concrete is being tremied it will displace the slurry forcing it upward. A holding tank large enough to hold the volume of slurry contained within the excavation is required to recycle the Shore Pac slurry. When concrete is tremie pumped into the bottom of the hole, the displaced Shore Pac slurry is pumped from the top of the excavation into the holding tank using a centrifugal pump. Disregard concerns about shearing the polymer and destroying it, this is the only pump that will pump a large enough volume to keep-up with the concreted pump truck.

Avoid pumping the last three feet of slurry above the concrete interface, this slurry will be contaminated from contact with the concrete. The impacted slurry looks like oatmeal and only occurs at the contact with the concrete. The last three feet of impacted slurry can be pumped off to a waste tank are allowed to spill over the top can onto the ground to be mixed into the spoil pile by the loader.

The recycled Shore Pac slurry is tested for viscosity and pH. While adding water to restore the original volume additional soda ash is added to adjust the pH. Next the Shore Pac is added to restore the slurry to full strength. Usually it requires about ¼ of the amount of Shore Pac added to the water filling up the holding tank to restore the slurry to its original strength for reuse on the next hole.

When adding fresh dry polymer to recycled fluid directly in the exaction, special care must be taken to assure good dispersion of the polymer grains to avoid forming lumps. This is because the polymer wets-out and disperses more slowly in thickened fluid than in plain water. Fanning

the recycled fluid across an auger or other object to provide a point of wide and rapid flow facilitates the adding of fresh dry polymer.

Circulation

The polymer slurry shall be circulated from the hole to a holding tank or to the next open hole when pouring concrete. A centrifugal trash pump will used for this purpose to keep up with the volume of concrete from the concrete pumping truck. The polymer is circulated within the excavation using the drilling tool. Recycled slurry will be delivered to the excavation using a double air diaphragm pump (wilden). Fire hoses will be utilized to pump the slurry from the holding tank to the excavation.

Desanding

The de-sanding operation is eliminated when using polymer slurry, as is necessary with bentonite mineral slurry. Bentonite slurry suspends sand and polymer slurry does not suspend sand. During the excavation of the shaft under a head of polymer slurry, all the sand drops to the bottom of the shaft as drilling proceeds

Shore Pac® Polymer Dosage and Viscosity

Shore Pac dosage and the viscosity of the slurry shall be selected and controlled within ranges which suit the soil and mix water conditions of the work and in accord with the table 3.1 below.

FORMATION	Shore Pac Dosage Rate*		Marsh Funnel Viscosity
	lbs/1,000gals	kg/m ³	
Clay & shale	3.4-4.0	0.29-0.36	45-55
Silt & fine to medium sand	4.0-5.0	0.36-0.48	45-65
Coarse sand to pea gravel	6.0-7.0	0.48-0.6	60-95
Gravels to cobbles	8.0-10.0	0.6-0.72	90-150

Selection of Polymer Slurry Materials

The principal polymer is Shore Pac, manufactured by CETCO Construction Drilling Products. Additives which have been certified by the manufacturer (CETCO) may be used with approval of the engineer and in accordance with the manufacturer’s recommendations. The strict quality control guidelines set forth in the California Department of Transportation (CALTRANS) requirements for approval of Shore Pac polymer drilling slurry have been applied to ensure the use of proven materials and techniques.

Mix Water Supply and Slurry Creation Ability

Sufficient water supply of proper quality for slurry makeup shall always be available to support planned operations and unknown contingencies. Ample slurry deliverability or making volume shall be immediately and continuously available to support planned operations and unexpected events. If the water supply is from a low-rate or irregular source such as a small well, a small diameter supply line, or tanker truck, a tank for storage of water shall be used to guarantee adequate and uninterrupted slurry making capacity.

Soda ash should be used to adjust the pH and treat out calcium (Ca) and magnesium (Mg) contaminants that are detrimental to polymers. This will adjust the pH of the mix water to an 8 - 10 reading on the pH indicator paper, which is optimum for Shore Pac performance. The ratio of

soda ash to water is 6 lbs per 1,000 gallons of water. The water situation varies based on location, alkalinity, hardness, and acidity. These conditions appear in city water or can be the result of alterations from soil or cement.

The additive De-Chlor™ is used to treat out chlorine (Cl) if municipal water is used for make up water. Chlorine, present in municipal water, destroys all polymer molecules and decreases its viscosity if chlorine registers greater than 3 ppm. De-Chlor is a cost-effective, white granular crystal that neutralizes chlorine in municipal water and is environmentally safe. The ratio of De-Chlor to water is 2 lbs per 1,000 gallons of mix water.

Contaminates

Polymer slurries are sensitive to various contaminants, which occur in groundwater, soil, cement, and make up water. Petroleum hydrocarbons, calcium, excessive acidity, excessive alkalinity, excessive chlorine, and sodium chloride are some contaminants that will affect the polymer slurry. These contaminants are often introduced into the slurry from the soil, groundwater and/or industrial wastes at the construction site. There is a need to identify and correct these problems for a smooth operation to take place. This begins with geotechnical engineers in the site investigation process. Identification and documentation should be present with soil logs and passed onto the general contractor and subcontractors. The procurement of samples of groundwater and the analysis of such samples for pH and contaminants should become a standard part of subsoil investigations conducted by geotechnical drilling service firms or by your own investigation. When contamination is present or buffering is required, additives shall be used in accordance with manufacturer's recommendations.

Each unique water condition can be solved with one or more of the following chemicals applied—Sodium Bicarbonate, Sodium Carbonate, Sodium Hydroxide, sodium hypochlorite—are DE-CHLOR.

Shore Pac® Mixing Directly in Excavation

The Shore Pac polymer may be mixed either directly within the excavation or pre-mixed in surface vessels. The mix water or the prepared fluid shall be treated with appropriate additives as specified by the manufacturer.

When mixing directly in the excavation it is important to have a steady stream of water or recycled fluid that is positioned to provide a point of rapid and wide water flow for introduction of polymer by sprinkling or sifting. Mixing of fresh polymer shall be completed by sprinkling or sifting the polymer carefully onto a flowing stream of water or fluid from a pressurized source directed into the excavation, such that the flowing fluid catches, wets and separates the polymer grains so that they disperse and hydrate as individual particles, avoiding the forming of lumps or balls of un-mixed polymer. Dry polymer shall not be added directly onto the fluid in the excavation (as opposed to being added on a flowing stream) because this normally produces lumps or "fisheyes."

When a new polymer mix is being prepared in a hole that has been dug to significant depth before adding slurry, the excavation shall be filled with water to a water column height (measured from bottom of excavation) of not less than one meter or 15% of excavation depth, whichever is the greater, before beginning to add the polymer. Shore Pac® dry granular polymer shall be added at a controlled rate on the stream of water that is filling the hole in order to avoid

lumps and fisheyes. The excavating tool (auger, bucket, clamshell) shall be reciprocated gently the full length of the slurry column while the polymer is being added, to distribute and even out the fresh polymer, and to assure that none of the polymer settles to the bottom of the excavation during the mixing and thickening process.

When adding fresh dry polymer to recycled fluid directly in the excavation, special care must be taken to assure good dispersion of the polymer grains to avoid forming lumps. This is because the polymer wets-out and disperses more slowly in thickened fluid than in plain water. Fanning the recycled fluid across an auger or other object to provide a point of wide and rapid flow facilitates the adding of fresh dry polymer.

Shore Pac[®] Mixing in Vessels or Tanks

When Shore Pac[®] polymer is pre-mixed in vessels it shall be added to water that is being passed through a hose, tube or hopper; across a stationary panel or surface; or stirred or otherwise agitated, in a manner which avoids the formation of lumps and results in a uniform mixture of polymer in the water. The polymer slurry shall be agitated until it develops viscosity adequate to be self-suspending (i.e., particles of partially-dissolved polymer do not settle in the fluid). This normally occurs within 15 to 30 minutes. Polymer shall not be mixed in a vessel without adequate agitation. Agitation may be accomplished by use of motorized stirrers, air injection, (as with blowpipes or fixed perforated piping), or other suitable and effective means. Recirculation by a single pump (without other means of agitation) is usually inadequate and shall not be permitted unless the mix tank is small enough that the pump provides adequate agitation of the entire tank.

Shore Pac[®] Slurry Maintenance

The slurry level shall be maintained at least 1.8 meters (six feet) above the water table, or as such higher level that is required to overbalance hydrostatic soil pore pressure and maintain soil stability. If the slurry drops below the specified level, the operation shall be paused and the proper slurry level re-established before proceeding. In some situations, the Manufacturer may recommend that the slurry be maintained at less than 1.8 meters above the water table, to reduce rates of fluid loss if soil stability is being maintained.

The point of reference for selection and maintenance of slurry level shall always be the water table (piezometric level). This applies even in situations where casing or other protective sleeve has been placed to a depth at or below the water table. The presence of casing does not remove the requirement to keep the slurry level above the water table. Attempts to excavate or hold open an excavation in saturated or unstable soils with inadequate slurry head pressure; even with casing extended into the water table, can be expected to result in soil collapse below the casing.

Disposal of Drilling Slurry

Treated slurry fluids are environmentally safe when handled as directed. When breakdown is complete, all that remains is trace acrylate molecules and water. The anionic Shore Pac is reduced to water after the hypochlorite is used to treat the Shore Pac. This is often safely discharged or simply spread on the ground to evaporate or used in dust control.

Additionally, polymers with the same chemical base as found in Shore Pac are used in potable water treatment as flocculants, with federal government clearance. They are widely used throughout the world as coagulants and flocculants used for environmental and process improvement, acting through solid/liquid separation. They are used in paper manufacturing, wastewater treatment, mineral and oil extraction, soil conditioning and as thickeners in cosmetics. As such, they have many regulatory approvals around the world, such as for drinking water treatment, indirect additives for food-contact paper and for other specific uses. Municipal sewage sludge, which has been polymer-treated for de-watering, is widely applied to agricultural land.

Break-Down of Slurry

Shore Pac slurry fluids are non-toxic and are readily degradable upon completion of a slurry job to facilitate disposal. Upon completion of the project, any remaining Shore Pac is broken down with the chemical oxidizer Slurry Buster.

The Slurry Buster hypochlorite solution is added to the Shore Pac slurry at a rate of 3 gallon per (3,000 gallons) of slurry to be treated. After Slurry Buster is added, the slurry is circulated using the pumps on-site to ensure complete oxidation of the polymer molecules. This is accomplished by pumping the slurry back into a holding tank.

Pumping the slurry back into the holding tank mixes Slurry Buster to immediately break down the Shore Pac polymer through oxidation. Water is the end result, ready to convenient disposal. Note: Dispose of produced water from Slurry Buster oxidation of Shore Pac slurry according to all applicable laws and regulations

Shore Pac® Polymer Slurry Products and Additives

[Shore Pac®](#)

Granular, water-soluble polymer designed for preparation of viscous earth-reinforcing fluids or slurries for a variety of drilling, trenching and walling applications in the geo-construction industry.

[XX-Poly™](#)

Shore Pac XX-Poly is a super concentrated form of Shore Pac polymer designed to be added directly into the hole. This liquid polymer instantly boosts viscosity in holes full of slurry and preserves the hole over-night. XX-poly will not freeze and is stable on the shelf.

[Insta-Clear™ Dry](#)

Dry granular flocculent reacts instantly to settle suspended solids. Insta-Floc Dry is designed to lower pH, break emulsions, and remove high levels of suspended solids. Ideally suited for totally cleaning polymer slurry.

[Sure-Seal™](#)

Granular, super-absorbent solidification and loss circulation material. Rapidly absorbs and retains large volumes of water from aqueous solutions, but only expands 1% in volume.

[Sand Sealant/Multi-Seal™](#)

Sand Sealant/Multi-Seal™ added to a hole filled with Shore Pac® slurry reduces slurry seepage into saturated open porous permeable cobbles sands & gravels.

[Stone Stop®](#)

Shore Pac Stone Stop granular sealant is composed of polymer-free, dried minerals in various mesh sizes. Stone Stop is coarser in size than Sand Sealant and controls slurry loss in extreme conditions.

Slurry Buster™

Industrial strength clean-up solution used to break synthetic polymer slurries like Shore Pac. Slurry Buster breaks polymer backbone through oxidation for quick disposal and clean-up.

De-Chlor™

Granular additive that neutralizes chlorine in municipal water. Prevents premature breakdown of drilling fluids and extends recycle life of polymer slurries.

Sodium Hydroxide

Packaged as Dry pearls, this chemical additive is added to the Shore Pac slurry to stop breakdown in viscosity caused by black organic soils and high concentrations of swampy organics.

Sodium Bicarbonate

Sodium Bicarbonate, NaHCO_3 is used to lower the pH of drilling slurry from a pH of 12-13 (alkaline) to a neutral pH range of 8-9. A white powder, Sodium Bicarbonate is also added when concrete has impacted the slurry as a pH neutralizing additive. A buffer sodium bicarbonate is added to acidic water to raise the pH to 8-9.

Soda-Ash

Soda-Ash is used to raise pH of make-up water for mixing of Shore Pac slurry by precipitating the soluble calcium. By adding 6 lbs per 1000-gallons mix water prior to adding Shore Pac the polymer yields faster and works more efficiently saving time and money.

SHORE PAC[®]

POLYMER SLURRY SYSTEM PROGRAM

PROJECT SPECIFIC PLANS UTILIZING
SHORE PAC[®]
IN THE CONSTRUCTION OF SLURRY DISPLACED DRILLED SHAFTS

DATE:

November 26, 2014

DESIGNED FOR:

**Donald E. Bottle, Jr.
Buffalo Drilling Company, Inc.
10440 Main Street
Clarence, NY. 14031
P: 716.759.7821 F: 716.759.7823**

PROJECT:

**Rutland Bridge Replacement
Rutland, VT.**

GEOTECHNICAL ENGINEER:

DESIGNED BY:

**Darlene Tokarsky
Northeast Territory Sales Manager**

REVIEWED BY:

**Justin Seago
Construction Sales Manager**

SLURRY PROPERTIES		
PROPERTY	VALUE	DESCRIPTION
SODA ASH	6	Lb SODA ASH per 1,000 gal water
SHORE PAC	9	Lb SHORE PAC per 1,000 gal water
pH	8-10	6 lbs of SODA ASH per 1,000 gal
Viscosity	85 to 95	Sec/qt
Density	64 or less	Lb/ft ³
Sand Content	1.0 % or less	To be tested at the bottom of the shaft before cage placement

GEOLOGICAL CONDITIONS		
PROPERTY	VALUE	DESCRIPTION
Static Water (Ft)	0.9' - 5.1'	Based on the time of construction and seasonal amount of precipitation, the groundwater level may be different than what is noted in the bore logs.
Soil Log Available	Yes	Bore Log B-103: Sand, little silt, compact, gray, wet. Clayey silt, little fine medium sand, little fine coarse gravel, medium coarse gravel. Bore Log B-201: Boulder, mostly broken rock w/sand, tan, moist. Light gray buff colored Dolomite with numerous closely spaced jointing. Hard to medium hard, slightly to moderately weathered, poor rock.

12' DIAMETER		
PROPERTY	VALUE	DESCRIPTION
Total Number of Shafts	1	Shaft
Casing Diameter (in)	144	12 foot diameter shaft
Hole Diameter gal/ft	845.54	Gallons per foot
Length of Casing	15	
Total Volume of Casing (gal)	12,684	1 shaft x 845.54 gallons per foot x 15 foot average depth = 12,684 gallons
Casing Diameter (in)	120	10 foot permanent casing
Hole Diameter gal/ft	587.18	Gallons per foot
Length of Casing	13	
Total Volume of Casing (gal)	7,634	587.18 gallons per foot x 13 foot average depth = 7,634 gallons
Casing Diameter (in)	96	8 foot permanent casing
Hole Diameter gal/ft	375.80	Gallons per foot
Length of Casing	18	
Total Volume of Casing (gal)	6,765	375.80 gallons per foot x 18 foot average depth = 6,765 gallons
Shaft Diameter (in)	96	8 foot diameter shaft
Hole Diameter gal/ft	375.80	Gallons per foot
Depth of Shaft (ft)	48	48 foot average depth.
Volume of Shaft (gal)	18,038	1 shaft x 375.80 gallons per foot x 48 foot average depth = 18,038 gallons
Estimated Over-break	10%	Based on soil conditions and experience, top casing and tooling
Estimated Over-break (gal)	1,804	18,038 gallons x 10% estimated overbreak = 1,804 estimated overbreak gallons
Total Volume of Shaft (gal)	19,843	18,038 gallons + 1,804 estimated overbreak gallons = 19,843 gallons
Estimated Total Volume (gal)	46,926	27,083 casing gallons + 19,863 shaft gallons = 46,926 total gallons
Total ft ³	6,274	
Total yd ³	233	

TOTAL VOLUME ESTIMATE		
PROPERTY	VALUE	DESCRIPTION
Total Shafts	1	1 shaft 12 foot in diameter
Basic Hole Volume (gal)	46,926	Gallons
Estimated Fluid Loss	35%	Fluid loss will occur because of loss in spoils, drilling procedures, tooling, drops in viscosity, recycle, gravel, and unknown theft zones.
Estimated Fluid Loss (gal)	16,425	46,926 gallons x 35% estimated fluid loss = 16,425 gallons estimated fluid loss
Estimated Total Gallons	63,351	46,926 gallons + 16,425 fluid loss gallons = 63,351

North America: 847.851.1800 | 800.527.9948 | www.CETCO.com

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OUR STANDARDS. YOUR PEACE OF MIND.

A Minerals Technologies Company

SITE SPECIFIC RECOMMENDATIONS

PHYSICAL PROPERTIES

This program is calculated based on 1 drilled shafts (12) ft in diameter. Total estimated total volume is 46,926 gallons. Based on boring logs the soil profile consists of sand, little silt, compact, gray, wet. Clayey silt, little fine medium sand, little fine course gravel, medium course gravel. Bore Log B-201 consists of boulders, mostly broken rock with sand, tan, moist. Light colored buff colored Dolomite with numerous closely spaced jointing. Hard to medium hard, slightly to moderately weathered, poor rock. The SODA ASH mixture should be 6 lbs per 1,000 gallons of mix water. In this application mix water should be at a pH of 10. This should be sufficient to maintain a pH of 10. The program will require **SHORE PAC polymer slurry with an estimated fluid viscosity of 85 to 95 seconds per quart for drilling procedures utilizing about 9 lbs of SHORE PAC per 1,000 gallons of mix water under these conditions.** We always recommend starting out with high viscosity until drilling consistency and production has been established. Although programs are designed based on geotechnical boring logs, because of unknown conditions or theft zones, even higher viscosity may be needed during drilling procedures which may demand more polymer/higher viscosity than specified.

Fluid loss is unknown but based on information from the boring logs we estimate fluid loss at 35%. Fluid loss will occur because of loss in spoils, drilling procedures, tooling, drops in viscosity, recycle, gravel, and unknown theft zones. Estimated overall fluid loss is 16,425 gallons. Total workable hole volume of 63,351 gallons. It could be more and it could be less.

TANKS

It is our recommendation to pre-mix in 1 21,000 gallon **open top tanks with no baffles or weir walls. Tanks must also be clean and free of any contamination that will adversely affect the slurry.** This is always dependent on locations, number of rigs in operation, and desired production. One tank should be dedicated to fresh slurry and mixing. While the remaining tanks should be used to recycle and boost the viscosity of used slurry. Finally, smaller tank, waste pit or poly tank should be used to hold SHORE PAC slurry contaminated by concrete.

MIX WATER SOURCE

A nearby, adequate, unlimited, water source needs to be available. The mix water source should be tested for pH, chlorine, and hardness. If river water is used, DE-CHLOR is not necessary. If water is extremely hard, SODA ASH should be added at about 6 lbs per 1,000 gallons.

ADDITIVES SUGGESTED

Additives are not suggested unless it is clearly determined that they may be needed. On this project it is suggested to use a combination of:

- **SODA ASH** - Is to be mixed at 6 lbs/1,000 gal to precipitate out calcium and magnesium or neutralize contamination.
- **C/S Granular** - Is a dry granular sodium bentonite material for fluid loss control.
- **SLURRY BUSTER DRY** - Is an industrial grade breaker is used at 15 lbs/10,000 gal to break down the slurry.

PUMPS

Centrifugal pumps will move the polymer slurry quicker and keep up with concrete pumping. The velocity and volume gained by using centrifugal pumps is worth the reduction in viscosity. It is common to use centrifugal pumps to recycle the slurry back to the holding tanks.

MIXING THE FIRST TANK

When using a 21,000 Tank – The tank may not be full, so this estimate is based on 19,000 gallons of mix water.

- **SODA ASH** – Mix 100 lbs or 2 pails of SODA ASH directly into the tank by inflow and circulate.
- **SHORE PAC** – Mix/Shear (#) lbs or (#) pails of SHORE PAC slowly into the tank at the inflow while tank is circulating or bubbling. Use a pump or bubbler system to circulate the slurry until homogenous.

HEAD PRESSURE

It is our recommendation to keep shafts as full as possible while drilling to exert maximum hydrostatic head pressure on the drilled formations unless cases of lower theft zones are encountered. If so keep hole full enough to maintain head pressure without sudden loss or force fluid to the formations.

For upper hole stability hydrostatic head pressure needs to be maintained at no less than 6' over static water at all times (more is better) to keep the hole open. When static water is near or at surface, top cans may have to be elevated out of the hole to maintain head pressure. Constructability with tooling and steel casing is at the driller's discretion.

SLURRY ENGINEERING OVERVIEW

- Client consultation with slurry engineers
- Research & development laboratory available if needed
- Analysis of boring logs & site specific recommendations
- Design of site specific slurry programs with recommendations
- Onsite slurry construction, monitoring and troubleshooting
- Onsite training of clients personnel in monitoring, testing and slurry construction
- Slurry technician certification available upon completion of required training
- Slurry Schools and seminars may be conducted at your location upon request
- A bio on our engineers can be provided upon request

FEES

Daily Fees - \$950.00 will be charged per day when an engineer is requested onsite to conduct site specific slurry training. It is important to note that the slurry engineer is there to train site personal on proper batch plant setup, mixing, testing procedures, monitoring and what to look for during the drilling process. Having a CETCO slurry representative onsite during the startup of a project helps ensure the initial success the contractor requires and the ability to speak with owners, regulatory agents and engineers on the functions of polymer slurry. Per Diem is included in this fee which may include but not limited to hotel, meals and rental car.

Weekly Fees – Are offered when the engineer will be on-site for a minimum of 5 days

Complimentary Days – These will be offered at the regional managers' discretion

Air Fare - \$650.00 will be charged for a round-trip ticket unless the customer postpones or cancels the engineer's services prior to purchase of airfare. This may or may not apply on local trips where extensive travel is not involved.

Daily Stand-By/Cancellation – A **\$450.00** charge will apply when agreement has been made that the engineer has to definitely be onsite at any given date and time but the customer is not ready for engineering services. This will also apply on weekly down time and partial days. This may or may not apply on local trips where extensive travel is not involved.

A two week notice is required to schedule a representative for onsite slurry engineering. This will allow for adequate time when scheduling and booking travel. Even though each representative has their own testing equipment, it is still required for the contractor to have or purchase their own slurry test kit and sample bailer. This equipment should be made available onsite when the representative arrives. If you do not have a slurry test kit, your regional manager can assist you in purchasing one.



Disposal of Shore Pac Slurry

Introduction

The use of synthetic polymer slurries as replacements for Bentonite and other minerals has become widespread. Key attractions of polymer slurries have been their degradability and low environmental impact, which has translated into reduced disposal difficulty for contractors.

The drilling slurry Shore Pac manufactured by CETCO Construction Drilling Products, to be used on a drilled shaft Project is not a hazardous waste, nor does it pose any threat to the waters of the State.

Is Polymer Slurry Toxic?

A Shore Pac slurry system can be classified as an acryl amide which falls under the general classification of a polyacrylamide. The acrylic contents of the molecule are non-hazardous and non-toxic. Shore Pac's chemical classification is listed in the U.S.A. EPA TSCA manual under code 25085-02-3. Shore Pac is identified as a non-toxic substance as defined by the U.S.A. Environmental Protection Agency. Shore Pac™ is approved for use by The Federal Highway Administration, (FHWA), and is used in States throughout the nation. The Method for disposing the drilling slurry Shore Pac on this Drilled Shaft Project has been listed within this correspondence.

Is Polymer Slurry Biodegradable?

Synthetic polymers are not readily biodegradable. Biodegradable means that slurry made from a biodegradable polymer will be subject to spoilage with breakdown of the slurry. Polymer slurry is not subject to spoilage. Shore Pac slurry is chemically degradable. Chemically degradability relates to chemical oxygen demand, or COD, and is the degrading of the polymer through interaction with another non-living substance. Shore Pac slurry is chemically degradable on demand by treatment with the chemical oxidizing agent Slurry Buster.

The Shore Pac Polymer slurry contacts the surrounding soil and groundwater during construction of cast-in-drilled-hole piling but does not migrate into the surrounding soil of the excavation due to a gel membrane that forms along the sidewalls of the borehole. This membrane cohesively binds the soils together forming temporary glue, which seals off the vertical liquid slurry column. The product Shore Pac being proposed for use as drilling slurry for the foundation project is not harmful to the environment.

Is Polymer Slurry able to be Broken Down?

At the end of the job there is usually a need to dispose of a quantity of polymer slurry which remains from the last borehole or excavation. The Shore Pac slurry is degraded by a variety of mechanisms. The polymer is broken down or removed from the slurry during use in drilling or excavating. The mechanisms which cause this include adsorption (bonding) onto earth soils and chemical reaction with alkalis and contaminants such as calcium in the slurry, the make-up water or the groundwater.

Shore Pac slurry fluids are non-toxic and are readily degradable upon completion of a slurry job to facilitate disposal. Upon completion of the project, any remaining **Shore Pac** is broken down with the chemical oxidizer (**Slurry Buster**) the most common oxidizer for this purpose.

The Slurry Buster solution is added to the Shore Pac slurry at a rate of 3-5 gallon per (3,000 gallons) of slurry to be treated. After the breaker is added, the slurry is circulated using the pumps on-site to ensure complete oxidation of the polymer molecules. This is accomplished by pumping it back into a holding tank.

The Slurry Buster destroys the active ingredients within the polymer and at the same time breaks the polymer, reverting it back to basic water. The end result of Shore Pac decomposing after its encounter with (**Slurry Buster**) is not a harmful substance.



Is Polymer Slurry Disposable?

Treated slurry fluids are environmentally safe when handled as directed. When breakdown is complete, **all that remains is trace acrylate molecules and water.** This is often safely discharged or simply spread on the ground to evaporate or used in dust control.

Additionally, polymers with the same chemical base as found in Shore Pac are used in potable water treatment as flocculants, with federal government clearance. They are widely used throughout the world as coagulants and flocculants used for environmental and process improvement, acting through solid/liquid separation. They are used in paper manufacturing, wastewater treatment, mineral and oil extraction, soil conditioning and as thickeners in cosmetics. As such, they have many regulatory approvals around the world, such as for drinking water treatment, indirect additives for food-contact paper and for other specific uses. Municipal sewage sludge, which has been polymer-treated for de-watering, is widely applied to agricultural land.

CETCO certifies that Shore Pac slurry is not harmful to the environment and is safe for disposal.

1	09-110	Feb-09	Gaetano Construction	Matt Brewing Co.	Utica	NY	CA	10 @ 30", 24 @36", & 4 @42" x 21 LF
2	09-111	Mar-09	Hayner Hoyt	Crouse Hines Hospital	Syracuse	NY	CA	6 @ 60" and 21 @ 72" x 16' OB + 10' rock
3	09-126	Jul-09	Rotha	Pearl St > P & W Railroad	Middleton	CT	CA	8 @ 1.22 M x 107 Meters *
4	10-122	Jun-10	O'Connell Electric	UB Light Foundations	Buffalo	NY	CA	8 @ 84" x 12' OB + 8' Rock Sock
5	09-130	Jul-10	Thalle	Gilboa Dam, Temp. Bridge Caissons	Catskill	NY	CA	21 @ 36" x 0 - 35 LF OB w/ 5 - 10 LF High RQD Sandstone
6	09-166	Mar-10	Hueber Breuer - Pike	St Joe's Addition	Syracuse	NY	CA	18 @ 36", 32 @ 48", 21 @ 60", 14 @ 72" , & 5 @ 84" x 21- 25 LF w/ Rock
7	11-143	Oct-11	Polivka International	Intermodal & Auto Light Foundations	Mechanicville	NY	CA	13 @ 48" x 30 LF includes 11' Shale Rock Sockets
8	11-116	Sep-11	Schultz Construction	Fulton County Retaining Wall	Mayfield	NY	CA	151m Shafts 20m Rock 189m Piles
9	11-137	Oct-11	DiPizio	Rt 238 Bridge > Stevens Brk	Attica	NY	SP	Rock Sockets - HP's- Lagging
10	10-115	Jul-10	Tunney Electric	Clarence Light Foundations	Clarence	NY	SH	4 - 30"x12' w 6-8 LF Limestone Bedrock
11	11-113	Aug-11	Holdsworth-Kilowski	Special Events Center	Brockport	NY	CA	22 @ 36" x 25 LF and 1 @ 48" x 25 LF
12	11-149	Feb-12	Pondview Construction	Bridge #02588 Rt 97 > Byron Brook	Norwich	NY	CA	20 Caissons 30" x 25 LF of Overburden and 2 LF Rock Sockets *
13	12-149	Aug-12	Rotha	Bridge #03824 Sigourney St	Hartford	CT	CA	8 Caissons 48" x 105 LF of Overburden and 5 LF Rock Sockets *
14	12-135	Mar-13	Pondview Construction	Bridge #05366 Laural Ln > Mt Hope River	Mansfield	CT	SH	8 Shafts 24" x 30 LF of Overburden and 3 LF Rock Sockets
15	13-160	Jul-14	William H. Lane, Inc.	RG&E SubStation Construction	Brighton	NY	CA	3 @ 96" & 10 @ 10 @ 60" x 60 LF of Overburden w/ Vibrated Perm. + Temp. Casing
16	14-116	Oct-14	Ecco III Construction	Stewart AFB Abutments & Piers	New Windsor	NY	CA	6 @ 60" & 8 @ 36" x 15-20 LF of OB w/ 54" & 30" x 11-14 LF Rock Sockets * **
17	14-134	Aug-14	Beck Construction	I-495 Bridge Repair	Wilmington	DE	CA	32 @ 48" x 160 LF of Overburden w/ 5' Rock Sockets *
18	14-143	Oct-14	Power and Const. Grp, Inc.	Limited Headroom Beneath 450 kva Wires	Rochester	NY	CA	4 @ 96" x 60' OB Mudded w/Permanent Casing

1	09-110	Anthony Obernesser	315-733-4611	*	Sonic Logging Analysis
2	09-111	Marty Rainbow	315-455-5941	**	Osterburg Load test
3	09-126	Russell Bush	860-678-7600		
4	10-122	Matthew McDonald	585-924-2176		
5	09-130	Craig Thompkins	919-201-0310		
6	09-166	Bill Pellenz	315.448.5672		
7	11-143	Michael Mann	704-806-6623		
8	11-116	Bill Steele	518-885-0060		
9	11-137	Rosanne DePizio	716-892-1097		
10	10-115	Brian Bartha	716-741-8284		
11	11-113	Michael Pesce	585-424-1920		
12	11-149	Bill Swale Jr.	860-668-2022		
13	12-149	Russell Bush	860-678-7600		
14	12-135	Bill Swale Jr.	860-668-2022		
15	13-160	Rick Austin	607-242-4827		
16	14-116	Bob Arbusto	914-963-3600		
17	14-134	Keith Anderson	210-842-4934		
18	14-143	Darla France	585-889-6016		

Don Morris has worked as an Operator and Supervisor on Projects 1, 2, 3, 4, 6, 7, 8, 12, 13, and 14, 15, 16, 17, and 18.

The ground man who could be working with Don might be one of many who have worked with him on many of these projects. Robert Fetter, Erik Sienkiewicz, or Brob Fromwiller are the most likely.

They have worked the listed projects as either operators, site supervisors, and lead ground men.

This will only be a two man crew with DA Collins supplying the additional labor to BDC as needed.

If these men are substituted for, the replacements will be parties who have worked with them on the above listed projects.

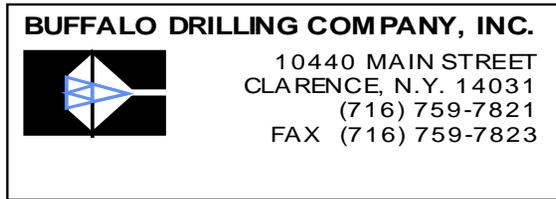
On-site supervisors and drill operators

BDC combines drill operators and site supervisors - one, possibly two of the following individuals will be working at the River Street Bridge Project. BDC also employs very competent ground men, but wouldn't consider them to be supervisors. Because BDC has a Geotechnical Drilling and Engineering Division, the listed operators have undergone both the operation and classification of soils using a geotechnical rig for instruction on soils and rock characteristics. We have found this to be one of those priceless training programs that allows our operators to learn to recognize soil types and be able to adapt when the provided geotechnical logs are either not accurate or taken a distance from where the actual construction is to take place. All three of the operators have had training sessions in mudding techniques, rig mechanics, lifting & hoisting, cable & sling safety, site management, tool-box meetings, and safety training. They have been involved in the construction of multiple hundreds of caisson and drilled soldier pile projects in NY, OH, MA, PA, CT, NH, VT, RI, ME, and WV..All have mudded shafts, cored through boulders, with oversized bits in order to advance casing, cored out rock sockets, have worked magnificently with owners, project managers, inspectors, and engineers, and have the capacity to analyze most any troublesome situation and resolve said issue. Mechanically speaking, these three are extremely competent when it comes to resolving rig problems and doing field repairs.

Their first day of employment with BDC is listed below.

- a) **Mark Bruning - Start 8-1-92** b) **Don Morris - Start 8-1-91** **Wally Greiner - Start 7-2-90** **Don Rimbeck - Start 5-6-91**

Temporary Casing Submittal



ATTN:

Project:

Date:

Bill Swale, Jr.

Pondview Construction

Replacement of Bridge 01903

U.S Route 1 > Stony Brook

Waterford, Connecticut

2-Oct-12

Submittal for Temporary Casing

Buffalo Drilling Company, Inc.(BDC) incorporates both new and used steel pipe in our temporary casing inventory.

The temporary sleeves that will be used for your project will consist of 48 and possibly 54 inch diameters of varying lengths - the determining factor will be how the soils react during drilling. Thickness will vary from .325 to .625 inches, and meets or exceeds the yield and tensile strengths of:

ASTM Spec. A53 Grade B

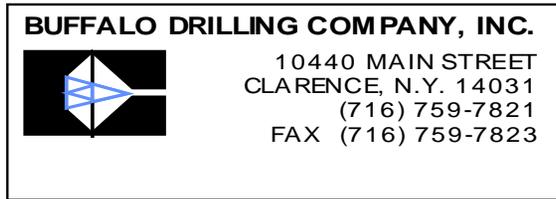
Minimum Yield Strength of 35,000 psi

Any midwelds that may be present are all constructed in house by BDC's certified welders.

BUFFALO DRILLING COMPANY INC.

Donald E. Bortle Jr.
Project Manager

Temporary Casing Removal Submit



ATTN: **Bill Swale, Jr.**
Pondview Construction
Projects: Replacement of Bridge 01903
U.S Route 1 > Stony Brook
Waterford, Connecticut
Date: 2-Oct-12

Submittal for Temporary Casing Removal

When temporary casing is required the extraction of said casing requires that specific procedures are adhered to.

Assuming the casing is already in place and concrete is ready to be poured two situations may arise, the hole may be dry or there may be water infiltration that can not be stopped.

Dry Hole - Concrete may be placed via freefall, tremie, or using elephant trunk in a continuous motion until the concrete is at least five feet above the bottom of the sleeve. At this time a sudden jerk on the sleeve to dislodge it from the bottom taking care not to raise it by more then three to six inches. Now the sleeve may be smoothly removed from the shaft while maintaining at least a five foot head above the bottom of the sleeve.

Wet Hole - If water infiltration can not be stopped then the water must reach its static level before concrete can begin to be poured. At this point concrete can be bottom dumped, pumped, or tremie poured till the concrete level rises to a minimum of five feet above the bottom of the sleeve. The water above the concrete can then be pumped and / or mucked off and the pipe removal procedure can mimic the procedure used in a dry hole while always maintaining a minimum five foot head above the bottom of the sleeve.

BUFFALO DRILLING COMPANY INC.

Donald E. Bortle Jr.
Project Manager

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIAL AND RESEARCH SECTION - STRUCTURAL CONCRETE UNIT

STRUCTURAL CONCRETE MIX DESIGN SUBMISSION

Concrete class: HPC AA
 Additional Description: With Fly Ash
 Ready Mix Supplier: CARRARA, JP & SONS INC - N CLARENDON, VT
 Designed By: Benjamin Cota
 Design strength: 4000 PSI
 Design by dry weight or saturated surface dry: SSD

Agency Use Only	
Mix ID	HP00-AA-0
Mix Design #	
Approved by	
Approved Date	
Spec Book Year	2013

Mix designs are valid for a 12 month period from date of approval or unless there is a change in material, material property or design parameter.

Cement:		Specific Gravity	<u>3.150</u>	<u>514</u> lb/cy	<u>2.61</u> cf
701.02	Source: <u>LEHIGH NORTHEAST CEMENT CO - GLENSFALLS, NY</u> Brand Name: <u>Lehigh Type I/II</u>				
Cement Type III:		Specific Gravity			<u>0.00</u> cf
701.04	Source: _____ Brand Name: _____				
Blended Cement:		Specific Gravity			<u>0.00</u> cf
701.06	Source: _____ Brand Name: _____				
Cement with Slag:		Specific Gravity			<u>0.00</u> cf
701.07	Source: _____ Brand Name: _____				
Pozzolan:		Specific Gravity			<u>0.00</u> cf
725.03(a)	Source: _____ Brand Name: _____				
Fly Ash:		Specific Gravity	<u>2.350</u>	<u>141</u> lb/cy	<u>0.96</u> cf
725.03(a)	Source: <u>HEADWATERS RESOURCES - BRAYTON POINT, MA</u> Brand Name: <u>Class F</u>				
Silica Fume:		Specific Gravity	<u>2.200</u>	<u>50</u> lb/cy	<u>0.36</u> cf
725.03(b)	Source: <u>W.R. GRACE & CO. - CAMBRIDGE, MA</u> Brand Name: <u>Force 10000</u>				
Slag:		Specific Gravity			<u>0.00</u> cf
725.03(c)	Source: _____ Brand Name: _____				
Water					
Air Content Target			<u>32</u> gals	<u>267</u> lb/cy	<u>4.28</u> cf
			<u>7.0</u> %		<u>1.89</u> cf
Coarse Aggregate 3/8"	Absorption <u>0.40</u>	Specific Gravity	<u>2.800</u>	<u>1400</u> lb/cy	<u>8.01</u> cf
704.02A	Source: <u>CARRARA JP - N CLARENDON, VT</u>				
Coarse Aggregate 3/4"	Absorption _____	Specific Gravity _____			<u>0.00</u> cf
704.02B	Source: _____				
Coarse Aggregate 1 1/2"	Absorption _____	Specific Gravity _____			<u>0.00</u> cf
704.02C	Source: _____				
Fine Aggregate:	Absorption <u>1.50</u>	Specific Gravity	<u>2.650</u>	<u>1470</u> lb/cy	<u>8.89</u> cf
704.01	Source: <u>PIKE IND PIT - DANBY, VT</u>	Fineness Modulus	<u>2.73</u>		
Air Entrainment Admixture		Specific Gravity	<u>1.000</u>	<u>2.5</u> oz/cy	
725.02(b)	Source: <u>W.R. GRACE & CO. - CAMBRIDGE, MA</u> Brand Name: <u>Darex II</u>				
Retarder Admixture:		Specific Gravity	<u>1.000</u>	<u>0</u> oz/cwt	
725.02(c)	Source: <u>W.R. GRACE & CO. - CAMBRIDGE, MA</u> Brand Name: <u>Daratard 17</u>				
High Range Water Reducer Admixture:		Specific Gravity	<u>1.000</u>	<u>16</u> oz/cwt	
725.02(h)	Source: <u>W.R. GRACE & CO. - CAMBRIDGE, MA</u> Brand Name: <u>Adva 405</u>				
Other Admixtures:		Specific Gravity	<u>1.000</u>	<u>0-7</u> oz/cwt	<u>0.00</u> cf
	Source: _____ Brand Name: <u>Sika Stabilizer 4R</u>				
	Source: _____ Brand Name: _____	Specific Gravity			<u>0.00</u> cf
	Source: _____ Brand Name: _____	Specific Gravity			<u>0.00</u> cf
	Source: _____ Brand Name: _____	Specific Gravity			<u>0.00</u> cf
		TOTAL	<u>53.000</u>	<u>3842</u> lb	<u>27.00</u> cf
		Maximum Water/Cementitious Ratio	<u>0.40</u>		
		Maximum Water (gal/cy)	<u>33.8</u>		
		Slump Min/Max (inch)	<u>20.0</u> min	<u>28.0</u> max	
		Air Content Min/Max (%)	<u>5.5</u> min	<u>8.5</u> max	
		Design Unit Wt. (lb/cf)	<u>142.30</u>		

Notes:

This is an SCC mix design with Class AA HPC proportions

Table T_PCC

Field Name	Data
MIX_ID	HP00-AA-0
DSN_T	PCC
RMRKS_ID	
MATL_CD	Concrete
PRODR_SUPP_CD	SC-CAR-02809
EFFDT	19000100
TERM_DT	19010100
DSNR_NM	Benjamin Cota
APPRD_DT	19000100
APPRD_BY_UID	0
CONC_CLAS_T	HPC2
MIN_AVG_STRGH_RQ	4000
DSN_STRGH_SPC	4000
H2O_CEM_RATIO	0.4
UNT_WT_M	142.30
UNT_WT_MEAS_UNT	lbsf
THEO_UNT_WT	142.30
THEO_UNT_WT_UNT	lbsf
AIR_CNTNT_M	7
SLMP_M	0
SLMP_MEAS_UNT	inch
LAST_MODFD_UID	0
LAST_MODFD_DT	19000100

Table T_PCC_BLND

MATL_CD	MIX_ID	DSN_T	PRODR_SUPP_CD	SMPL_ID
701.02	HP00-AA-0	PCC	PC-LEH-02224	
	HP00-AA-0	PCC	#N/A	
	HP00-AA-0	PCC	#N/A	
	HP00-AA-0	PCC	#N/A	
	HP00-AA-0	PCC	#N/A	
725.03(a)	HP00-AA-0	PCC	PC-HEA-02856	
725.03(b)	HP00-AA-0	PCC	AD-WRG-00010	
	HP00-AA-0	PCC	#N/A	
704.02A	HP00-AA-0	PCC	AG-CAR-01100	
	HP00-AA-0	PCC	#N/A	
	HP00-AA-0	PCC	#N/A	
704.01	HP00-AA-0	PCC	AG-PIK-01231	
725.02(b)	HP00-AA-0	PCC	AD-WRG-00010	
725.02(c)	HP00-AA-0	PCC	AD-WRG-00010	
725.02(h)	HP00-AA-0	PCC	AD-WRG-00010	
	HP00-AA-0	PCC	No Data	
	HP00-AA-0	PCC	No Data	
	HP00-AA-0	PCC	No Data	

End

BRND_NM	SPC_GR	BULK_SP_G	ISSD_WT_M	ABS_P	FINE_MODULMAS	
Lehigh Type I/		3.15				514
	0	0.00				0
	0	0.00				0
	0	0.00				0
	0	0.00				0
Class F		2.35				141
Force 10000		2.20				50
	0	0.00				0
		2.80	1400	0.40		1394
		0.00	0	0.00		0
		0.00	0	0.00		0
		2.65	1470	1.50	2.73	1448
Darex II		1.00				2.5
Daratard 17		1.00				0
Adva 405		1.00				16
Sika Stabilizer		1.00			0-7	
	0	0.00				0
	0	0.00				0

UNT_T	LAST_MODFI	LAST_MODFD_DT
flb	0	19000100
foz	0	19000100
goz	0	19000100
goz	0	19000100
goz	0	19000100
#N/A	0	19000100
#N/A	0	19000100

Lehigh Northeast Cement Company Lehigh Northeast Cement Company



313 Warren Street, PO Box 440

Glens Falls, NY USA 12801

Office Phone #: 1-(518)-792-1137

Toll-Free Office Phone #: 1-(800)-833-4157

Fax Phone #: 1-(518)-792-0731 (fax)

Mill Test Report

Plant Location: Glens Falls., NY
 Mill Test Date: 3/18/2014

Cement Type: Type I/II
 Mill Test Month: Feb-14

ASTM C 114	Test Results Results	ASTM C150 / AASHTO M 85
		TYPE II Specifications
Silicon Dioxide (Si ₂ O ₃), %	20.38	
Aluminum Oxide (Al ₂ O ₃), %	4.06	6.0 Max
Iron Oxide (Fe ₂ O ₃), %	4.19	6.0 Max
Calcium Oxide (CaO), %	63.40	
Magnesium Oxide (MgO), %	2.16	6.0 Max
Sulfur Trioxide (SO ₃), %	3.38	3.0 Max*
Loss on Ignition (LOI), %	1.49	3.0 Max
Insoluble Residue, %	0.50	0.75 Max
Total Alkalies [Na ₂ O + 0.658*K ₂ O] (%):	0.68	0.60 / 0.70* Max (*NYDOT Only)
Tri-Calcium Silicate [C ₃ S] (%):	60.32	
Tri-Calcium Aluminate [C ₃ A] (%):	3.68	8 Max
C ₃ S + 4.75*C ₃ A ≤ 100	77.8	100 Max
ASTM C186 Heat of Hydration 7 Day (cal/g)	79.0	
Date Heat of Hydration Performed	8/17/2012	
CO ₂ (%)	#DIV/0!	
Limestone Addition (%):	#DIV/0!	5.0 Max
CaCO ₃ in Limestone (%)	95.3	70 Min

PHYSICAL REQUIREMENTS

Blaine Fineness ASTM C 204 (m ² /kg):	371	280 Min/ 420Max* (* AASTHO Only)
325-Mesh Sieve Retained ASTM C 430(%):	4.17	
Time of Setting Vicat - Initial Set ASTM C 191 (min):	173	45 Min
Time of Setting Vicat - Final Set ASTM C 191 (min):	265	375 Max
Air Content ASTM C 185 (%):	6	12 Max
Paste False Set ASTM C 451 (%):	68.0	
Soundness-Autoclave Expansion ASTM C 151(%):	-	0.80 Max
Expansion in Water ASTM C 1038 (%):	-	0.020 Max
Normal Consistency ASTM C 187 (%):	25	
Compressive Strengths 1 Day ASTM C109 (psi):	2093	
Compressive Strengths 3 Day ASTM C109 (psi):	3688	1450 Min
Compressive Strengths 7 Day ASTM C109 (psi):	4448	2470 Min
Compressive Strengths 28 Day ASTM C109 (psi):	5465	

The above test results are representative of cement from which the shipment was made.

The cement complies with the requirements of ASTM C 150 and AASHTO M 85 specifications.

Note - ASTM and AASHTO refer to footnote "d" in cases where the optimum SQ (using ASTM C 593) of a particular cement is close to or in excess of the limit in this specification, in such cases where properties of a cement can be improved by exceeding the SQ limits in the table, it is permissible to exceed the limits provided it is demonstrated by ASTM C 1038 that the cement with the increased SQ will not develop expansion exceeding 0.020% at 14 days. The optimum SQ for GFLCC Type I/II cement exceeds the limit and therefore the ASTM C 1038 results are provided above.

Hermanus Potgieter

Hermanus Potgieter, Quality Control Manager



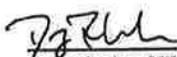
**ASTM C618 / AASHTO M295 Testing of
Brayton Point Fly Ash**

Sample Type: 3200-ton	Report Date: 5/23/2014
Sample Date: 3/28 - 4/8/14	MTRF ID: 679BP
Sample ID:	

Chemical Analysis	ASTM / AASHTO Limits		ASTM Test
	Class F	Class C	Method
Silicon Dioxide (SiO ₂)	59.24 %		
Aluminum Oxide (Al ₂ O ₃)	25.83 %		
Iron Oxide (Fe ₂ O ₃)	5.94 %		
Sum of Constituents	91.01 %	70.0% min 50.0% min	D4326
Sulfur Trioxide (SO ₃)	0.16 %	5.0% max 5.0% max	D4326
Calcium Oxide (CaO)	1.48 %		D4326
Magnesium Oxide (MgO)	1.26 %		
Sodium Oxide (Na ₂ O)	0.73 %		
Potassium Oxide (K ₂ O)	2.40 %		
Moisture	0.05 %	3.0% max 3.0% max	C311
Loss on Ignition	2.42 %	6.0% max 5.0% max	C311 AASHTO M295
Available Alkalies, as Na ₂ O When required by purchaser	0.81 %	not required 1.5% max 1.5% max	C311 AASHTO M295
Physical Analysis			
Fineness, % retained on #325	19.49 %	34% max 34% max	C311, C430
Strength Activity Index - 7 or 28 day requirement			C311, C109
7 day, % of control	92 %	75% min 75% min	
28 day, % of control	93 %	75% min 75% min	
Water Requirement, % control	96 %	105% max 105% max	
Autoclave Soundness	-0.02 %	0.8% max 0.8% max	C311, C151
Density	2.33		C604

The strength activity index is not to be considered a measure of the compressive strength of concrete containing the fly ash.

Headwaters Resources certifies that pursuant to current ASTM C618 protocol for testing, the test data listed herein was generated by applicable ASTM methods and meets the requirements of ASTM C618.


Doug Rhodes, CET
Facility Manager



Materials Testing & Research Facility
2650 Old State Highway 113
Taylorsville, Georgia 30178
P: 770.684.0102
F: 770.684.5114
www.headwaters.com



ATLANTIC TESTING LABORATORIES

Albany
22 Corporate Drive
Clifton Park, NY 12065
518-383-9144 (T)
518-383-9166 (F)

TRANSMITTAL

June 24, 2013

J.P. Carrara & Sons, Inc.
PO Box 60
North Clarendon, VT 05759

Attn: Mr. Robert Carrara

E/mail: bob@carraraconcrete.com

Re: Laboratory Test Results
Sand and Stone Samples
ATL Report No. AT1241SL-12-15-06-13

Ladies/Gentlemen:

On June 7, 2013, your representative delivered two sand and two stone samples (ATL sample Nos.1241S12 – AT1241S15) to our Clifton Park, New York facility for testing. Specific Gravity and Absorption of Coarse Aggregates in accordance with ASTM C 127, Specific Gravity & Absorption of Fine Aggregates in accordance with ASTM C 128, and Grain Size Analysis in accordance with ASTM C 136 / C 117, were performed on these samples. The laboratory test results follow:

Specific Gravity and Absorption of Fine Aggregate

ASTM C 128
Carrara Sand

ATL Sample Number	Client I.D.	Specific Gravity (OD)	Bulk Specific Gravity (SSD)	Apparent Specific Gravity	Absorption (%)
AT1241S12	Carrara Sand	2.62	2.65	2.70	1.1

State Sand

ATL Sample Number	Client I.D.	Specific Gravity (OD)	Bulk Specific Gravity (SSD)	Apparent Specific Gravity	Absorption (%)
AT1241S13	State Sand	2.62	2.65	2.71	1.3

Specific Gravity and Absorption of Coarse Aggregate

ASTM C 127

¾ inch ledge - RUTLAND STONE

ATL Sample Number	Client I.D.	Specific Gravity (OD)	Bulk Specific Gravity (SSD)	Apparent Specific Gravity	Absorption (%)
AT1241S14	¾" Ledge	2.79	2.80	2.83	0.4

**Los Angeles Abrasion
ASTM C 131**

ATL Sample No.	Client I.D.	Nominal Maximum Size	Grading	Percent Loss (%)	NYS DOT Specification (%)	ASTM Specification (%)
AT1241S18	P-Stone	1"	B	33.2	35	50

**Specific Gravity and Absorption of Fine Aggregate
ASTM C 128
Carrara Sand**

ATL Sample Number	Client I.D.	Specific Gravity (OD)	Bulk Specific Gravity (SSD)	Apparent Specific Gravity	Absorption (%)
AT1241S20	Carrara Sand	2.62	2.66	2.72	1.3

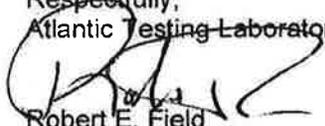
**Specific Gravity and Absorption of Fine Aggregate
ASTM C 128
Pike Sand**

ATL Sample Number	Client I.D.	Specific Gravity (OD)	Bulk Specific Gravity (SSD)	Apparent Specific Gravity	Absorption (%)
AT1241S21	Pike Sand	2.61	2.65	2.72	1.5

The Particle size distribution curves are enclosed.

Please contact our office should you have any questions or if we may be of further service.

Respectfully,
Atlantic Testing Laboratories, Limited


Robert E. Field
Laboratory Manager
bfield@atlantictesting.com

REF/nd

WR Grace Company

W. R. Grace & Co.-Conn.
62 Whittemore Avenue
Cambridge, MA 02140

T 617-498-4555
F 617-234-7576
E Denise.i.white@grace.com
W www.graceconstruction.com

April 6, 2011

J P Carrara & Sons
2464 Case Street, Rte. 116
Middlebury, Vermont 05753

Project Name: All

This is to certify that **DAREX® II AEA**, an air-entraining admixture, as manufactured and supplied by Grace Construction Products, W. R. Grace & Co.-Conn., is formulated to comply with the Standard Specification for Air-Entraining Admixtures for Concrete, ASTM C 260 (AASHTO M 154).

DAREX II AEA does not contain calcium chloride or chloride containing compounds as a functional ingredient. Chloride ions may be present in trace amounts contributed from the process water used in the manufacturing.

GRACE



Denise White
Technical Service Support

WR Grace Company

W. R. Grace & Co.-Conn.
62 Whittemore Avenue
Cambridge, MA 02140

T 617-498-4555
F 617-234-7576
E Denise.i.white@grace.com
W www.graceconstruction.com

April 6, 2011

J P Carrara & Sons
2464 Case Street, Rte. 116
Middlebury, Vermont 05753

Project Name: All

This is to certify that **ADVA® 405**, a high-range, water-reducing admixture, as manufactured and supplied by Grace Construction Products, W. R. Grace & Co.-Conn., is formulated to comply with the Standard Specification for Chemical Admixtures for Concrete, ASTM C 494, Type F (AASHTO M 194, Type F) and complies with the Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete, ASTM C 1017.

ADVA 405 does not contain calcium chloride or chloride containing compounds as a functional ingredient. Chloride ions may be present in trace amounts contributed from the process water used in the manufacturing.

GRACE



Denise White
Technical Service Support

WR Grace Company

W. R. Grace & Co.-Conn.
62 Whittemore Avenue
Cambridge, MA 02140

T 617-498-4555
F 617-234-7576
E Denise.i.white@grace.com
W www.graceconstruction.com

April 6, 2011

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Project Name: All

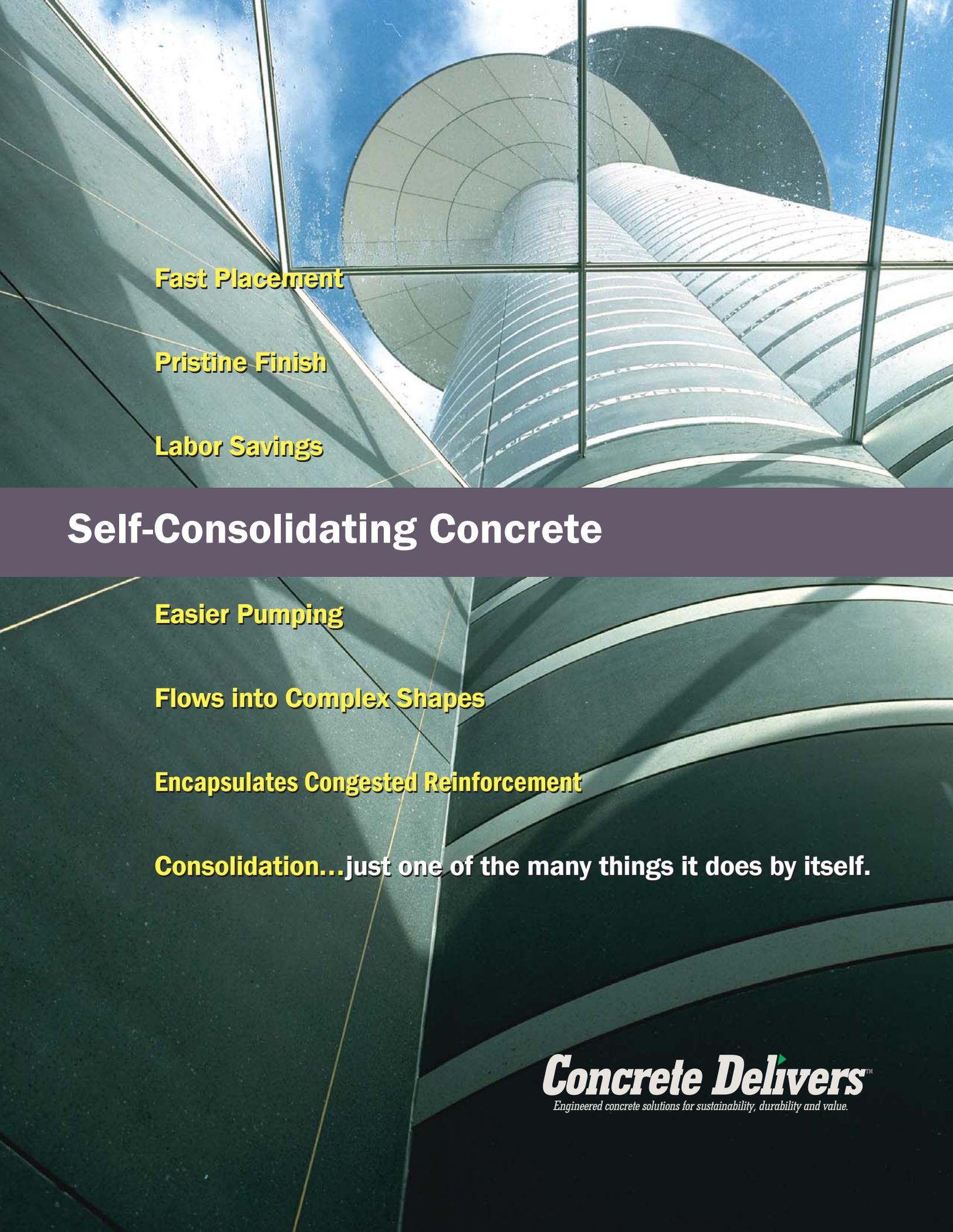
This is to certify that DARATARD® 17, a Water-Reducing and Retarding, as manufactured and supplied by Grace Construction Products, W. R. Grace & Co.-Conn., is formulated to comply with the Standard Specification for Chemical Admixtures for Concrete, ASTM C 494, Type D (AASHTO M 194, Type D).

DARATARD 17 does not contain calcium chloride or chloride containing compounds as a functional ingredient. Chloride ions may be present in trace amounts contributed from the process water used in the manufacturing.

GRACE



Denise White
Technical Service Support



Fast Placement

Pristine Finish

Labor Savings

Self-Consolidating Concrete

Easier Pumping

Flows into Complex Shapes

Encapsulates Congested Reinforcement

Consolidation... just one of the many things it does by itself.

Concrete Delivers™

Engineered concrete solutions for sustainability, durability and value.

Self consolidating concrete (SCC), also known as self-compacting concrete, is a highly flowable, non-segregating concrete that can spread into place, fill formwork and encapsulate even very congested reinforcement, without any mechanical vibration. As a high-performance concrete, SCC delivers these attractive benefits while maintaining all of concrete's customary mechanical properties and durability characteristics.

SCC's unique properties give it significant economic, constructability, aesthetic and engineering advantages. SCC is an increasingly attractive choice for optimizing site

manpower by reduction of labor and possibly skill level, lowering noise levels and allowing for a safer working environment. SCC allows easier pumping - even from bottom up, flows into complex shapes, transitions and inaccessible spots and minimizes voids around embedded items to produce a high degree of homogeneity and uniformity. That's why SCC allows for optimized concrete sections and shapes, denser reinforcement and greater freedom of design while producing superior surface finishes and textures.



SCC's economic benefits are built-in.

Labor and time-to-completion are significant components of any job's economic picture. Since SCC flows easily, self-levels with minimal consolidation, placement is quick and easy, saving placement time, vibration equipment and time, labor and equipment wear and tear. SCC's potential high early form stripping strength and smooth finish mean faster turnaround and minimal cosmetic repairs and a positive impact on maintaining projects on schedule. By eliminating the need for consolidation, SCC results in fewer safety and noise concerns and costs.



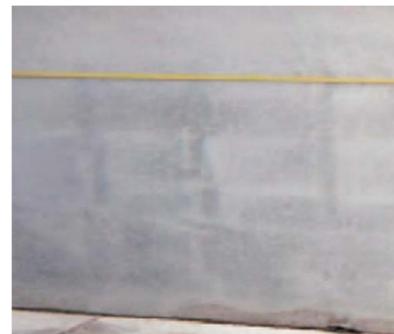
SCC's economic advantages are greatest when high strength is an existing prerequisite.

Consolidation is just one of the great things self-consolidating concrete does by itself.

SCC delivers significant engineering benefits.

As an engineered concrete, SCC offers characteristics that engineers value. Improved constructability to produce homogeneous and uniform concrete allows for higher reliability in design assumptions. Engineering properties and their inter-relationships remain unchanged from those of conventional concrete and any differences are adequately addressed by conservatism in the design codes. The principles of concrete durability with respect to reduced permeability, resistance to freezing and thawing and sulfate attack, alkali-aggregate reactions, thermal stresses and corrosion protection of reinforcement also apply similarly to SCC. SCC's superior rheology allows for the design and construction of complex shapes with congested reinforcement, and its non-segregating qualities are important for deep-section or long-span applications. The fluidity of SCC can be engineered in terms of its viscosity -

both rate and degree of flow - to allow for a wider variety of placement and construction means and methods.



SCC (above) results in nearly zero surface defects, especially when compared to standard concrete (below).



“It's hard to believe that such a difficult concrete pour was completed with such ease”

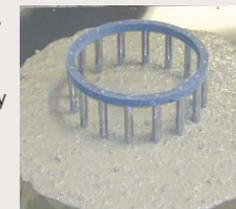
Concrete Superintendent

SCC gives architects more design flexibility.

SCC's unique characteristics give architects much more flexibility for vertical and horizontal applications. SCC's flowability allows for more complex and aesthetic concrete design features. Unlimited opportunities exist with innovative options for color and texture of exposed surfaces. Perhaps most importantly, SCC produces exposed surfaces that are virtually defect free, allowing concrete's beauty to shine

SCC: A high-performance concrete innovation.

SCC's flowability is generally achieved by using polycarboxylate-based high-range water-reducing (HRWR) admixtures and optimized concrete ingredients while maintaining a low mixing water content in the concrete. SCC's stability, or resistance to segregation of the plastic concrete mixture, is achieved by using mineral fillers or fines and/or by using viscosity modifying admixtures.



Find out for yourself why SCC works wonders.

Next time you have a job that calls for the considerable economic, aesthetic, engineering or design benefits of self-consolidating concrete make sure it's at the top of your list. To learn more, visit www.SelfConsolidatingConcrete.org.



SCC solves difficult problems: Because of a lack of overhead clearance, SCC was pumped from the bottom into these 101' tall, 28" wide, steel-reinforced columns.



SCC offers advantages when heavy reinforcement is involved: SCC's rheological characteristics allow it to flow easily through congested reinforcement.

Self Consolidating Concrete Delivers Efficiency, Beauty, Savings and More.

Economic Benefits

- Fast placement without vibration or other forms of mechanical consolidation
- Reduced equipment wear
- Labor savings
- Easier placement over any distance or constraints
- Accelerate project schedules
- Reduced noise, safety and environmental concerns

Engineering and Architectural Benefits

- Improves constructability
- Virtually flawless finish
- Homogeneous and uniform concrete
- Flows easily into complex shapes and through congested reinforcement
- Allows for innovative architectural features
- Superior strength and durability

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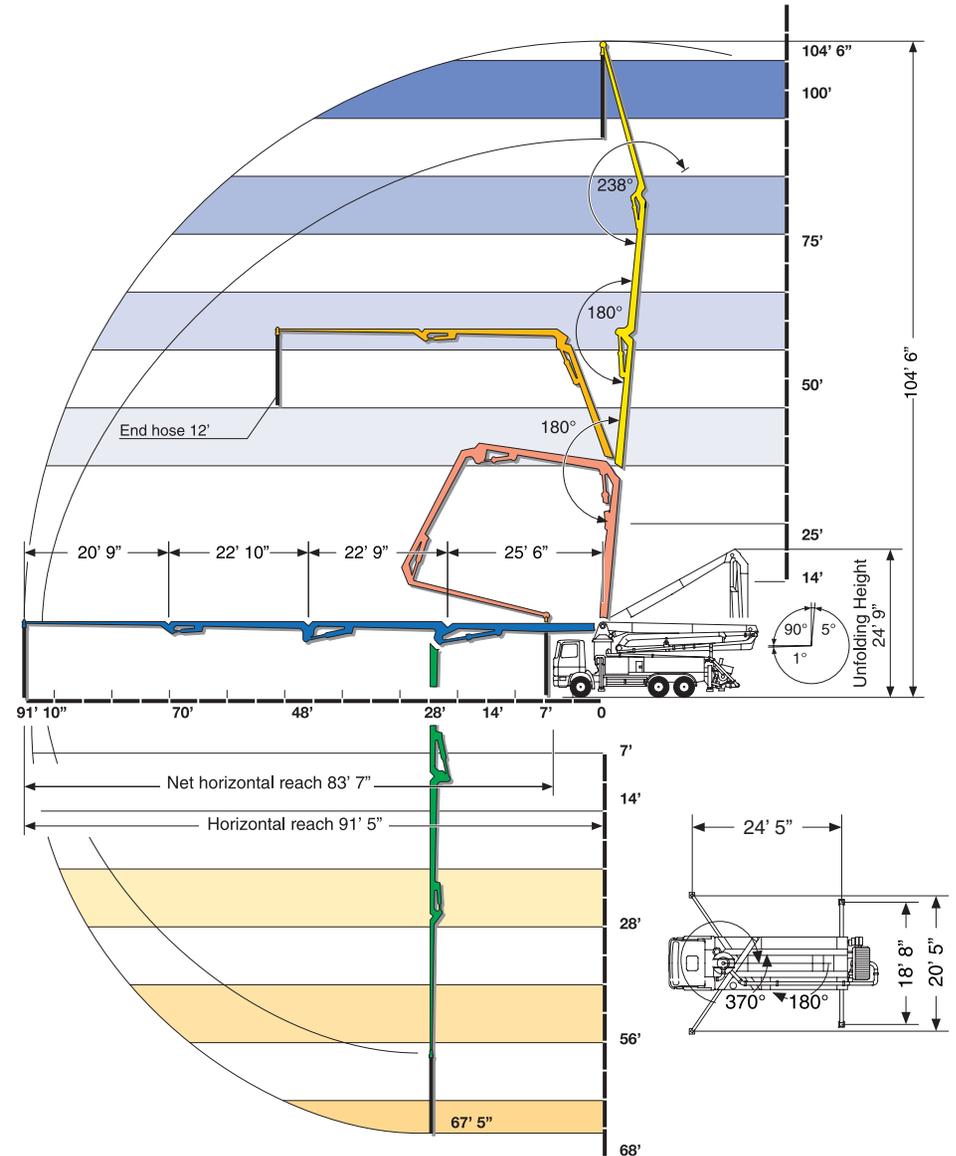
S 32 X

SPECIFICATIONS

	U.S.	Metric
Vertical Reach	104' 6"	31.8 m
Horizontal Reach	91' 5"	27.8 m
Below Grade Reach w/ Tip Hose	67' 5"	20.5 m
Pipeline Diameter	5 in	125 mm
Boom Type/ Sections	Full Articulation, Roll & Fold/ 4	
Boom Rotation	540 degrees	
Unfolding Height	24' 9"	7.5 m
Outrigger Type- Front	X Outriggers, Fully Hydraulic, Extension & Jacking	
Outrigger Type- Rear	Hydraulic Slewing & Jacking	
Outrigger Soil Pressure w/o Dunnage (front/rear)	234/138 psi	16.1/9.5 bar
Outrigger Soil Pressure w/ Dunnage (front/rear)	57/47 psi	3.9/3.2 bar
Outrigger Width, Front	20' 5"	6.2 m
Outrigger Width, Rear	18' 8"	5.7 m
Outrigger Length	24' 5"	7.4 m

PUMP SPECIFICATIONS

	U.S.	Metric
Theor. Concrete Output	178 cu yds/h	136 cu m/h
Max. Pressure on Concrete	1102 psi	76 bar
Max. Strokes Per Minute	23	
Max. Aggregate size	2.5 in	63.5 mm
Material Cylinder Diameter	10 in	254 mm
Material Cylinder Stroke	79 in	2006.6 mm
Differential Cylinder Diameter	4.7 in	120 mm
Maximum Oil Flow	132.1 gal/min	500 l/min
Hydraulic Circuitry Type	MPS	
Valve Type	B Rock	



*Pump specifications are for standard units. Other units are available. Specifications are subject to change without prior notice.



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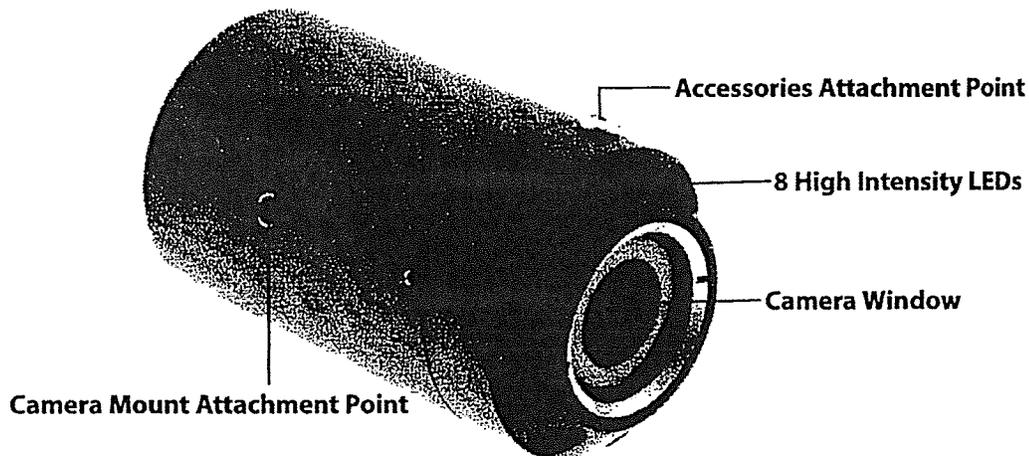
Color-GS-0008

B&W-GS-0009

The GeoVISION™ Standard Plastic Color and Black & White cameras are a great economical choice when the conditions are right. Standard Plastic cameras are designed for use in two-inch (5 cm) and larger diameter bores up to 1,000 feet (300 meters) deep. These cameras are more sensitive to heat than Standard Stainless Steel cameras, and cannot be stored or operated in environments hotter than 110° F (43° C). They can be used alone or mounted on a Pan-Tilt Control for easy joystick manipulation.

The Standard Plastic cameras have standard NTSC resolution with an aspect ratio of 4:3. Illumination is provided by eight high intensity white LEDs. Standard Plastic cameras are rated for use up to 500 psi and can be used with Light-Duty, Heavy-Duty and Deluxe winches.

Standard Plastic cameras have a mounting screw near the front of the camera for attaching accessories such as a side-looking mirror or a ball compass. In shallow wells, these cameras can be connected to a pipe-string providing an economical way to pan and tilt the camera from the surface.



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Specifications:
Standard Plastic Color Camera

Weight	4.5 Ounces
Dimensions	3-3/8" long x 1-5/8" diameter (8.6 cm x 4.1 cm)
Standard Lens	2.97 mm
Angle of View (in air)	~130°
Aperture	F2.0
CCD	1/3" Sony Super HAD CCD II
Video Format	NTSC
Horizontal Resolution	550 Lines
Effective Pixels	768 Horizontal x 494 Vertical
Minimum Illumination	0.05 Lux.
Operating Temperature	-40° F ~ 110° F (-40° C~43° C)
Light Source	8 High Intensity White LEDs
Maximum Depth	1000 Feet Underwater (300 meters)
Maximum Pressure	500 psi
Current Draw	120 mA
Window Material	Glass
Exposure Control	No

Standard Plastic Black and White Camera

Weight	4.5 Ounces
Dimensions	3-3/8" long x 1-5/8" diameter (8.6 cm x 4.1 cm)
Standard Lens	3.6 mm
Angle of View (in air)	~92°
Aperture	F2.0
CCD	1/3" Sony ExView B/W CCD II
Video Format	NTSC
Aspect Ratio	4:3
Horizontal Resolution	420 Lines
Effective Pixels	510 Horizontal x 492 Vertical
Minimum Illumination	0.0003 Lux.
Operating Temperature	-40° F ~ 110° F (-40° C~43° C)
Light Source	8 High Intensity White LEDs
Maximum Depth	1000 Feet Underwater (300 meters)
Maximum Pressure	500 psi
Current Draw	160 mA
Window Material	Glass
Exposure Control	No

Compatibility

Accessories

Products	Notes:	Additional Lights
Winch		Auxiliary Single Light
Deluxe	Maximum cable length is 1,000 feet (300 meters).	Auxiliary Double Light
Heavy-Duty		Auxiliary Fixed Eight Light
Light-Duty		Auxiliary Adjustable Eight Light
Cable Length		Camera Mounted Options
325 feet (100 meters)	Deluxe, Heavy-Duty or Light-Duty winch.	Pan-Tilt Control
650 feet (200 meters)	Deluxe or Heavy-Duty winch.	Compass
1,000 feet (300 meters)	Deluxe or Heavy-Duty winch.	Fixed Mirror

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CHOOSE A LANGUAGE:
English



GeoVISION BORE HOLE CAMERA SYSTEMS

Home » Standard Plastic

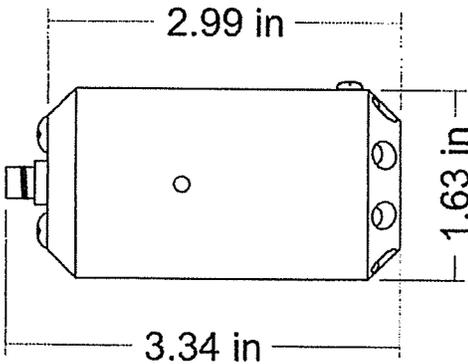
GeoVISION™ Standard Plastic Cameras

OVERVIEW

SPECS

ACCESSORIES

COMPATIBILITY

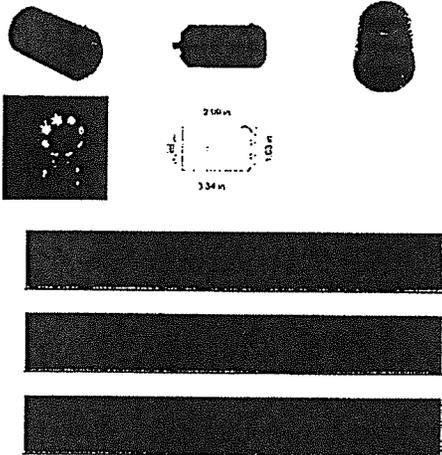


The GeoVISION™ Standard Plastic Color and Black & White cameras are a great economical choice when the conditions are right. Standard Plastic cameras are designed for use in two-inch (5 cm) and larger diameter bores, up to 1,000 feet (300 meters) deep. These cameras are more sensitive to heat than Standard Stainless Steel cameras, and cannot be stored or operated in environments hotter than 110° F (43° C). They can be used alone, or mounted on a Pan-Tilt Control for easy joystick manipulation.

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MARKS PRODUCTS, INC.

Geo VISION, Jr.™
Econo Light-Duty
& Heavy-Duty

BOREHOLE VIDEO SYSTEMS

MODEL # GVLDECONOM1 & # GVHDECONOM1

OWNER'S MANUAL

(READ THIS MANUAL BEFORE USING THE SYSTEM)

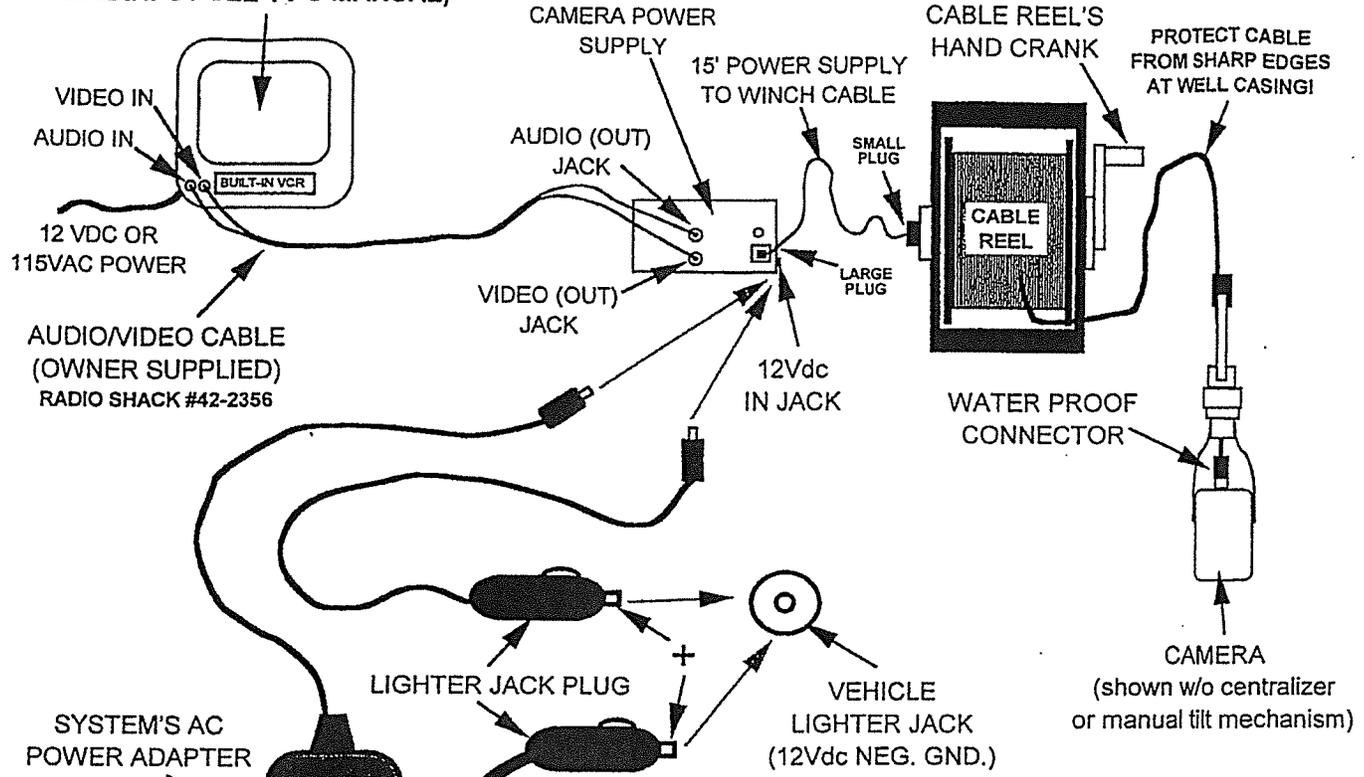
MARKS PRODUCTS, INC.
1243 BURNSVILLE RD.
WILLIAMSVILLE, VA 24487
(800) 343-3479(540) 396-4740
FAX: (540) 396-4741

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FIG. #1 GeoVISION Jr™ ECONO LIGHT-DUTY SYSTEM HOOK-UP DIAGRAM

(SEE FIGS. 21 & 22 FOR OPTIONAL 5" B/W & 5.6" LCD MONITOR HOOK-UP)

OWNER SUPPLIED TV/VCR COMBO OR CAMCORDER
(BE SURE TO SET INPUT TO AV OR LINE INPUT SEE TV'S MANUAL)



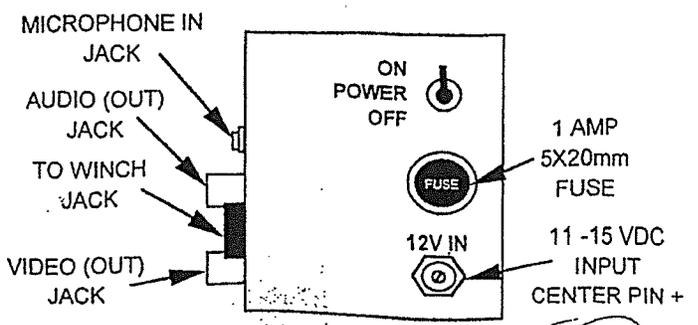
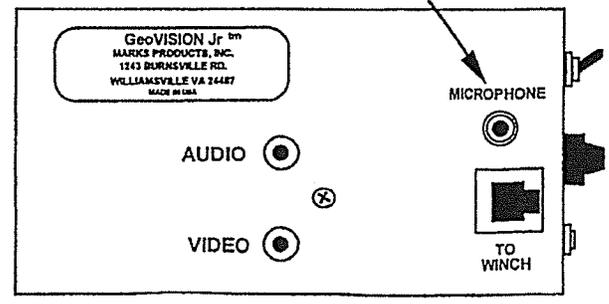
SYSTEM'S AC POWER ADAPTER

115V ac 60 Hz POWER

12Vdc TO 115V ac 60 Hz POWER INVERTER (300W) CAN BE USED TO POWER SYSTEM AND/OR TV/VCR (OPTIONAL)

CAMERA POWER SUPPLY

TO RECORD SOUND PLUG IN AN OWNER SUPPLIED MICROPHONE (RADIO SHACK # 33-3013)



#8-32 X 5/8" S.S. BUTTON HEAD CAP SCREW.
USED TO TIGHTEN & LOOSEN CLAMP
(DO NOT OVER TIGHTEN!!)
(ONE EACH SIDE)

TO REMOVE CLAMP FROM CABLE LOOSEN
SCREWS A SEPARATE THE TWO HALVES

3 CONDUCTOR CABLE WITH
FOOTAGE PRINTED ON CABLE
(COMING FROM CABLE REEL)

FIG. #2

GeoVISION Jr™ CAMERA WITH CENTRALIZER ATTACHMENT

(SHOWN WITHOUT TILT HEAD ATTACHMENT)
THIS CONFIGURATION WILL FIT INTO 2" BORE

SUPPORT-CLAMP
(ADJUST SO THAT THE SUPPORT-CLAMP
SUPPORTS THE CENTRALIZER AND CAMERA)
THE CONNECTOR AT THE CAMERA
SHOULD NOT SUPPORT ANYTHING

STAINLESS STEEL
SUPPORT STRAP
(ONE EACH SIDE)

SUPPORT-CLAMP'S
MALE PIPE ADAPTER (CPVC)

#4-40 X 1/4" S.S. PAN HEAD
PHILLIPS SCREW
(4 EACH SIDE)

CENTRALIZER'S 3/4"
FEMALE PIPE
ADAPTER
(CPVC)

UPPER HOSE CLAMP
(STAINLESS STEEL)
(TIGHTENED TO ALLOW
SLIDING UP AND DOWN ON
THE CENTRALIZER PIPE
WHILE ADJUSTING STRAPS
TO BORE DIAMETER)

CAMERA CENTRALIZER
(CPVC)

NYLON CENTRALIZER
STRAP (TOTAL OF 4.
ONE NOT SHOWN)

LOWER HOSE CLAMP
(SHOULD BE TIGHTENED SO
THAT IT DOES NOT SLIDE)
STAINLESS STEEL

CAMERA SUPPORT'S 3/4"
FEMALE PIPE ADAPTER
(CPVC)

#4-40 X 1/4" S.S. PAN HEAD
PHILLIPS SCREW
(TWO EACH SIDE)

3 CONDUCTOR CABLE SHOULD NOT
BE SUPPORTING THE CAMERA
(THE SAFTY SUPPORT CLAMP SUPPORTS THE
CENTRALIZER AND CAMERA)

SCREW-ON CONNECTOR
(THIS COLLAR SHOULD BE FINGER
TIGHT ONLY)

THE CONNECTOR SHOULD NOT SUPPORT
THE CAMERA OR CENTRALIZER
PINS SHOULD BE COATED WITH SILICON GREASE

STAINLESS STEEL
CAMERA SUPPORT STRAP
(ONE EACH SIDE)

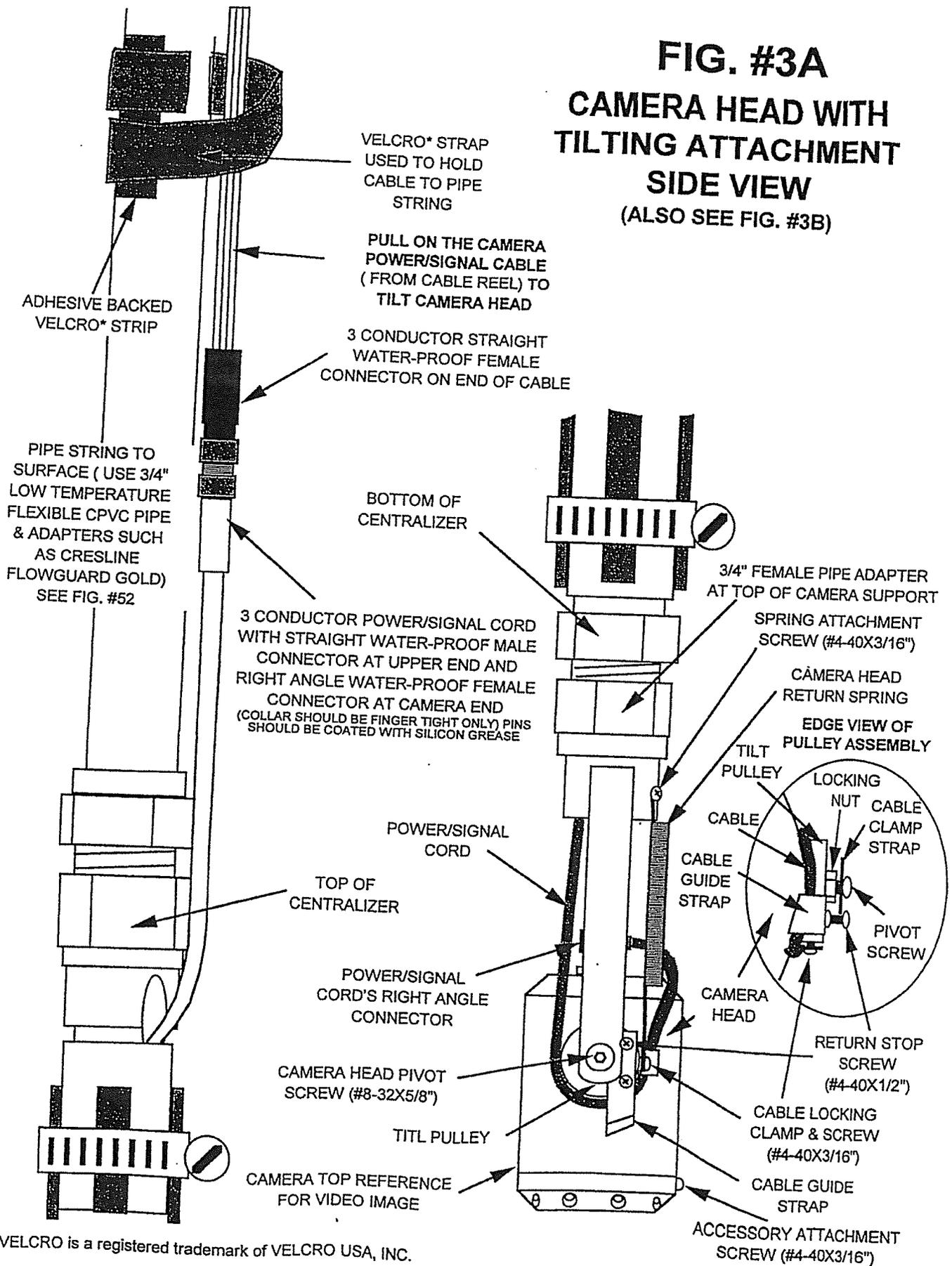
CAMERA HOUSING PIVOT SCREW.
WHEN NOT USING TILTING
ATTACHMENT USE #8-32 X 3/16" S.S.
BUTTON HEAD CAP SCREW.
TIGHTEN TO HOLD CAMERA ANGLE
(ONE EACH SIDE)
(DO NOT OVER TIGHTEN!!)

B/W OR COLOR
CAMERA HEAD

CAMERA LENS WINDOW

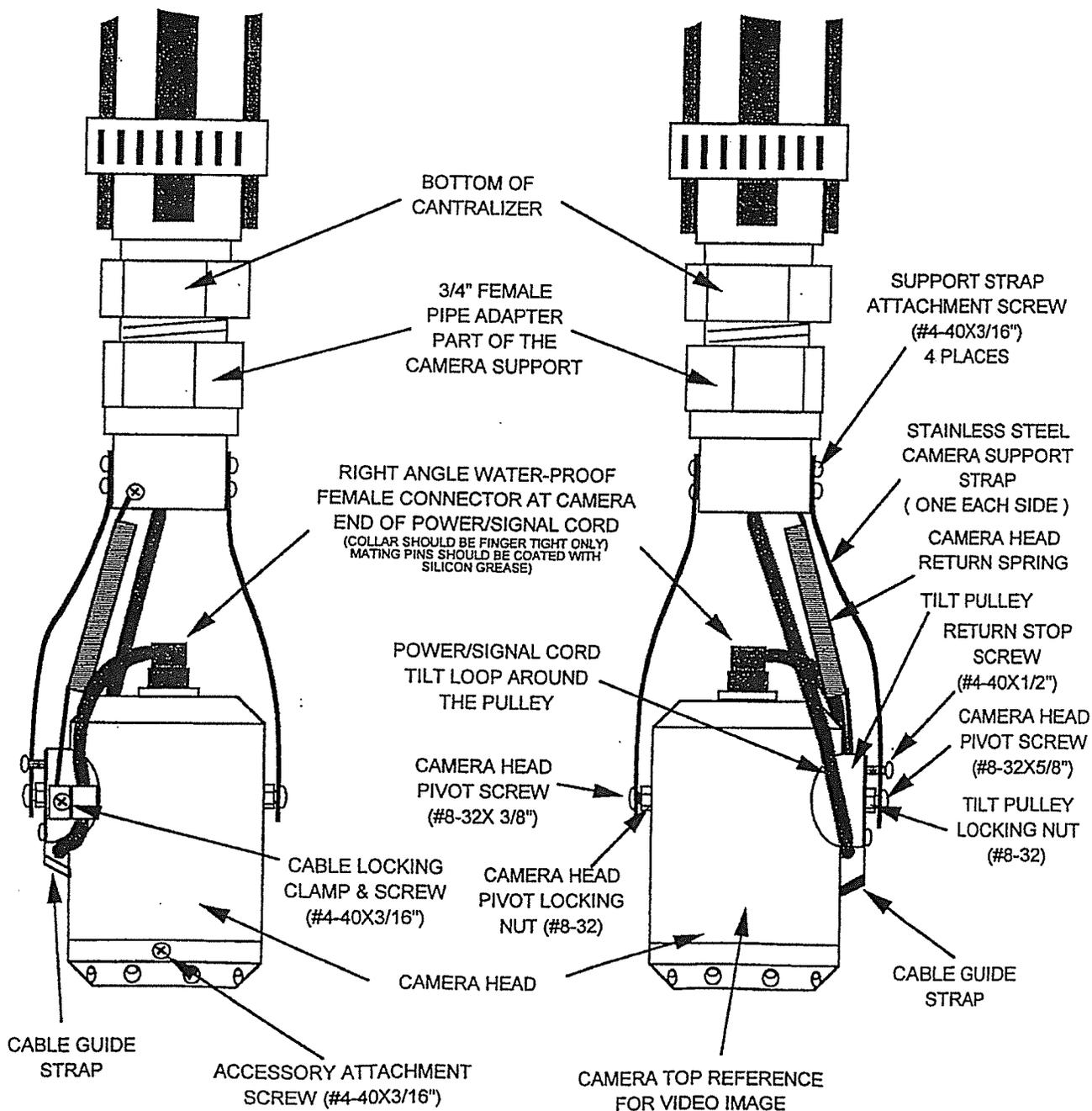
BUILT IN LIGHT SOURCE
(8 WHITE LEDS, 4 SHOWN)

FIG. #3A
CAMERA HEAD WITH
TILTING ATTACHMENT
SIDE VIEW
 (ALSO SEE FIG. #3B)



* VELCRO is a registered trademark of VELCRO USA, INC.

FIG. #3B CAMERA WITH SUPPORT AND TILT-HEAD ATTACHMENT (SEE FIG. #3A)



**BOTTOM OF
CAMERA VIEW**

**TOP OF
CAMERA VIEW**

470

FIG. #4

SUPPORTING CAMERA W/O CENTRALIZER AND TILTING ATTACHMENT

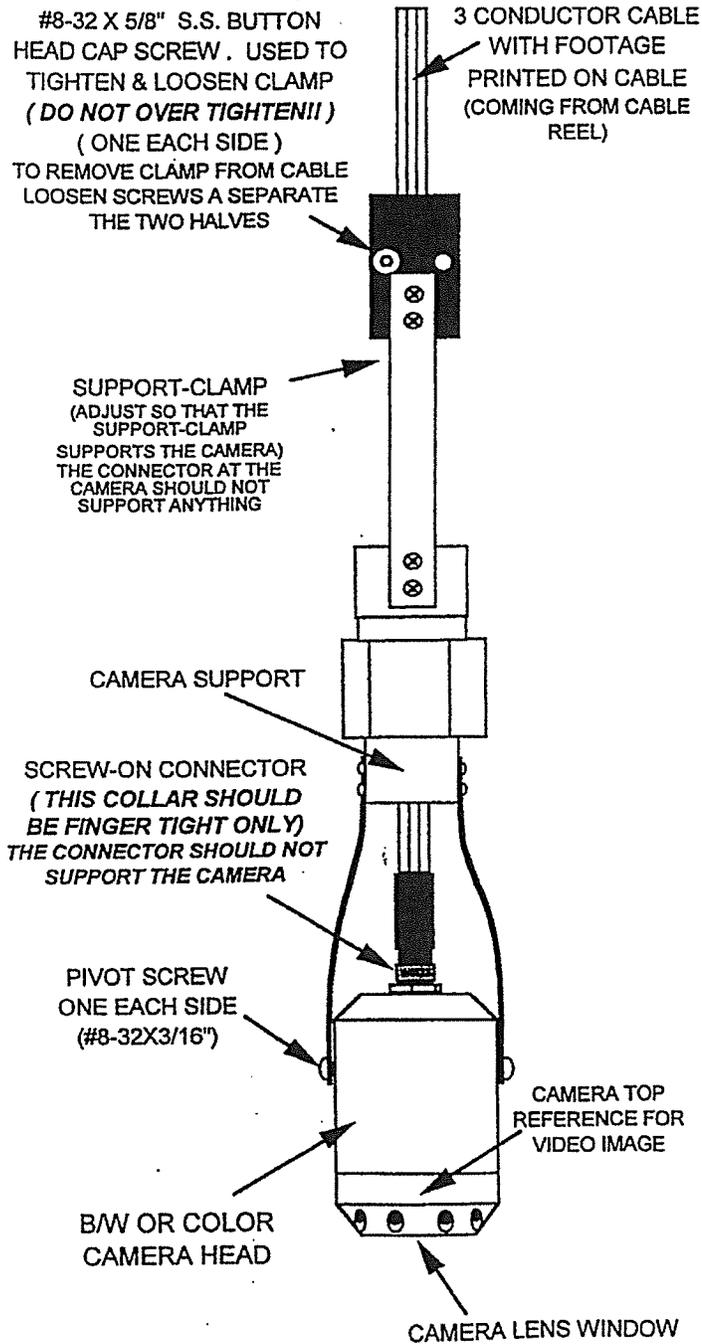
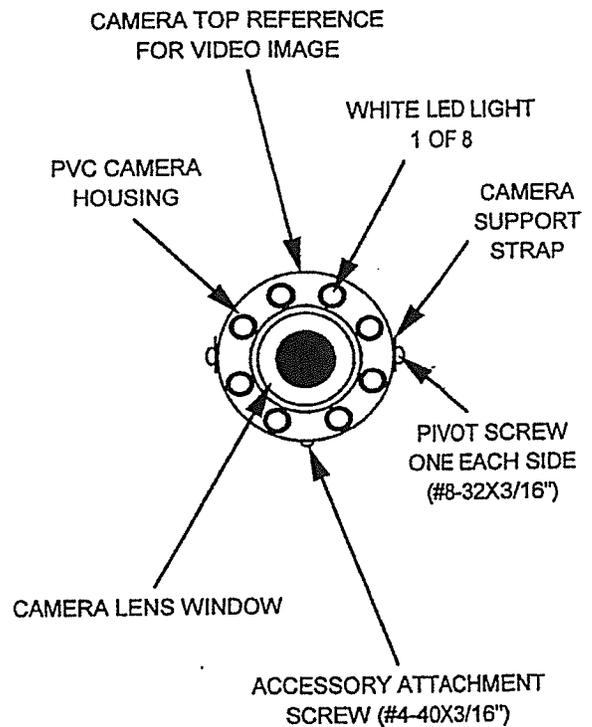


FIG. #5

CAMERA HOUSING FRONT VIEW (W/O TILTING ATTACHMENT)



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Pile Dynamics, Inc.

Cross-Hole Analyzer™



Cross-Hole Analyzer

CHA-QX SPECIFICATIONS

Physical

Size: 155 x 320 x 385 mm
Weight: 8 kg
Screen: High contrast VGA backlit transfective LCD display for all lighting conditions
Screen Size: 10.4 inches (26.4 cm)
Operating temperature range: 0 to 40°C.
Power: 120-220 VAC (50-60HZ) to 12 VDC converter or 12V battery; Internal backup battery for up to 30 min of operating time
Built-in water resistant keyboard and mouse

Electronic

512 MB DRAM minimum
40 GB Hard Disk minimum
Serial, Parallel, Ethernet and USB ports
CD-RW Drive
Analog to digital converter resolution: 12 bits
Sampling rate: 500 KHz
Scan rate: 60 scans, (pull rate of up to 1.5 m/s)
User adjustable gain, trigger and transmission power level

Other

Operates in English or SI units
PC-compatible Pentium® (or equivalent) processor with Windows® XP operating system
Furnished with CHA-W software
User manual included
One year warranty

The Cross-Hole Analyzer (CHA) uses Crosshole Sonic Logging technology to determine the quality and consistency of concrete between pairs of PVC or steel tubes pre-installed in drilled shafts, slurry walls, bored piles, cast-in-situ piles and other types of concrete foundations.

The Cross-Hole Analyzer is available in the original model CHA-QX and a smaller model CHAMP. Both models are housed in rugged enclosures.

The CHA-QX features a keyboard and color screen and runs on Windows XP. It allows the tester to perform a complete real time data analysis with CHA-W, as well as data review and report preparation in the CHA-QX itself.

The CHAMP is smaller, lighter and operable through a color touch screen visible in all lighting conditions. The CHAMP operates with an internal battery designed to last an entire day of normal testing conditions. It allows for essential real time analysis (waterfall diagram) on site. Data transfer is accomplished through a PCMCIA card to a computer for data review with CHA-W, Tomography Imaging, and report preparation.



PROBES (FOR CHA-QX AND CHAMP)

Transmitter frequency (nominal): 100KHz
Transmitter voltage: 600 – 800 volts (user selectable)
Maximum transmitter rate: 60 Hz
Diameter: 25 mm
Length: 185 mm (7.3") (add-on weight 56 mm / 2.2")

Element: Ceramic
Enclosure: Brass
Cable length: 60m, 100m or 150m
Cable jacket: High strength PVC

Probes are enclosed by sturdy, oil-filled brass shells that have been pressure tested for water depths up to 1000 ft. Transmitter probes have an exclusive safety feature; they are powered by a 12 volt source in the probe and transformed to higher voltages within the probe itself. These higher voltages allow testing between access tubes more than 2 m apart. The probes may be fitted with bottom extension weights for deeper shafts and centralizers to assure that probes stay in the tube center.



A transmitter lowered down one tube sends a high frequency signal through the concrete that is detected by a receiver in another tube. As these sensors are raised and/or lowered along the length of the foundation, they progressively scan the concrete for signal strength versus time and depth. Scanning various tube combinations for the entire shaft allows evaluation of concrete quality and defect location along the length and by quadrant. The CHA can also be used for single hole logging of smaller augercast piles.

Both CHA models meet or exceed the requirements for Crosshole Sonic Logging of ASTM standard D6760.

CHAMP SPECIFICATIONS

Physical

Size: 115 x 190 x 240 mm

Weight: 4.2 kg

Screen: VGA sunlight readable touch screen display

Screen Size: 8.4 inches (21.3 cm)

Operating temperature range: 0° - 40°C

Power: Internal 12V battery (lasts at least 5 hours in data collection mode)

Electronic

PCMCIA drive including removable memory card \geq 128 MB

Analog to digital converter resolution: 12 bits

Sampling rate: 500 KHz

Scan rate: 60 scans/s (pull rate allows up to 1.5 m/s)

User adjustable gain, trigger and transmission power level

Other

Operates in English or SI Units

Windows CE operating system

Furnished with CHA-W software

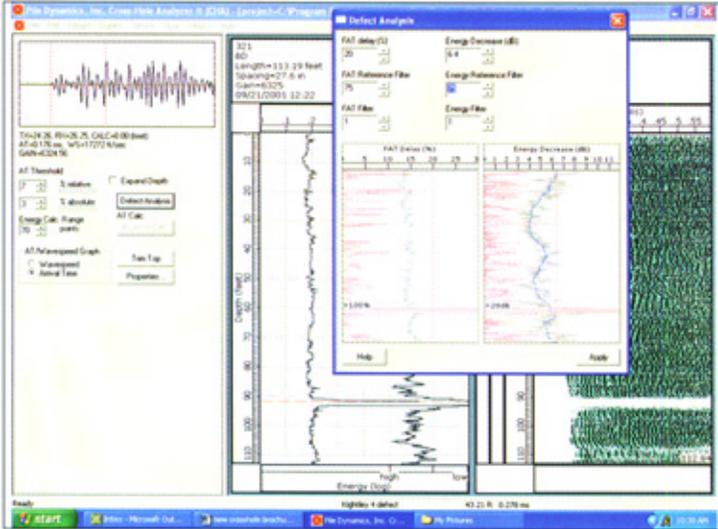
User manual included

One year warranty



Both the CHA-QX and the CHAMP support dual high resolution encoders to independently track the depth and direction of probe movements; data can be taken in both upward and downward movements of the probes. The encoders may be placed directly on the piles for maximum accuracy, or using a tripod for convenience.

CHA-W Software



The CHA-W software processes the data collected with either the CHA-QX or the CHAMP. CHA-W runs in the CHA-QX or in any computer running Windows 2000, XP or above.

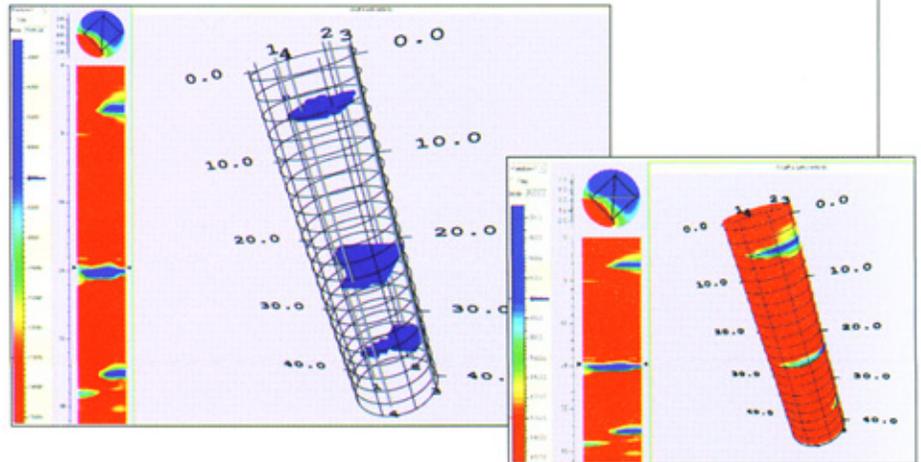
CHA-W assures that all complete signals are recorded and data from all tube combinations are collected, provides powerful tools to analyze the collected data and produces clear graphs such as:

- **Sonic Map:** Shows signal strength versus time and depth in traditional waterfall diagram.
- **First Arrival Time (FAT):** shows the signal travel time from the transmitter to receiver, versus depth.
- **Wave-speed Plot:** Shows wave-speed as an indicator of concrete strength, versus depth. A tabular wave-speed output shows wave-speeds, means and standard deviations.
- **Energy or Amplitude Plot:** Indicates signal strength versus depth.

CHA-W features include EDGE FINDER™ and DEFECT ANALYSIS™. Most crosshole sonic logging analyses are based on the First Arrival Time of the signal; CHA-W detects FAT with the signal imaging techniques of EDGE FINDER. (Optional automatic threshold and manual override selections are available). Signal strength is a supplementary method to detect defects. CHA-W evaluates signal strength either by integration of the signal over time, or by evaluating peak amplitude. The DEFECT ANALYSIS feature helps the user find defects by setting the thresholds for FAT delay and/or for energy decrease. When DEFECT ANALYSIS finds a defect, the CHA-W output shows its location graphically (horizontal red line) and in table format. The program includes tools that customize its output and aid report preparation.

Tomosonic

Geophysical software imaging company GeoTomo developed the TomoSonic software exclusively for use with the Cross-Hole Analyzer. Tomosonic is useful when CHA-W reveals a local defect shown in some but not all tube combinations. This optical tomography software uses 2-D and 3-D imaging to produce color coded presentations that help visualization of local defects. Tomosonic views include horizontal and vertical slices and a three dimensional representation of the shaft.



Quality Assurance for Deep Foundations
4535 Renaissance Pkwy Cleveland Ohio 44128 USA
tel: +1-216-831-6131 fax: +1-216-831-0916
Email: info@pile.com www.pile.com

APPENDIX A

DESCRIPTION OF THE CSL METHOD AND THE CHA EQUIPMENT

The following has been written by GRL Engineers, Inc. and may only be copied with its written permission.

1. CSL INSTRUMENTATION

GRL performs the Crosshole Sonic Logging (CSL) according to the specifications of ASTM D6760-02 using the Cross Hole Analyzer (CHA) system manufactured by Pile Dynamics, Inc. The CHA system is applied to shafts, which are equipped with at least two inspection tubes. The tubes are either made of steel or plastic and must be filled with water during curing to promote proper bonding of the tube with the concrete and during testing to couple the signal to the concrete. In one of the water filled tubes, a transmitter probe is lowered and simultaneously a receiver probe is lowered in the second tube, normally to the same level as the transmitter tube. The CHA then generates an electric pulse. For typical CSL applications, the frequency of the signal generated is above the audible limit (around 100 kHz for the CHA) and therefore ultrasonic. The stress wave travels through the water, the tube and the concrete and is then received by the receiver probe as an electrical signal. The wave transmission proceeds at the speed of sound in the concrete (typically between

3,000 and 4,000 m/s or between 10,000 and 13,000 ft/s) and CSL is therefore often called a sonic test. The received signal is amplified, converted to digital form at a rate of 500 samples per millisecond, and then digitally stored and displayed by the CHA. The total record length is 256 samples and, therefore, is a ½ millisecond total duration. For longer tube spacing the wave travel time may approach or exceed ½ ms, so the CHA operator selects a **Time Delay (TD)** following the transmitter signal emission so that the leading edge of the pulse is included in the digitized record.

While recording the received signal, the CHA measures the **Depth** of the transmitter and receiver by means of individual digital encoders. This depth measurement is normally done relative to the tube top or the tube bottom. Typically, transmitter and receiver are simultaneously raised and, in intervals of 1 or 2 inches (user selectable), signals are emitted and recorded.

As an alternative to Crosshole Sonic Logging, **Single-Hole Sonic Logging (SSL)** is sometimes a preferable solution, particularly for small diameter shafts. In this case the transmitter and receiver are lowered at a fixed vertical distance into the same water filled access tube. To avoid misinterpretations, the tube has to be made of plastic for this application. Many of the features of the resulting scans can be obtained and interpreted as for CSL, however, since this method is less seldom used, it is not described here in further detail since the principles are identical to CSL.

2. PRESENTATION OF RESULTS

Historically, the display of the records is done in the so-called **Waterfall Diagram**. This presentation shows in a binary fashion the positive records components dark and the negative record components white as a function of time. The

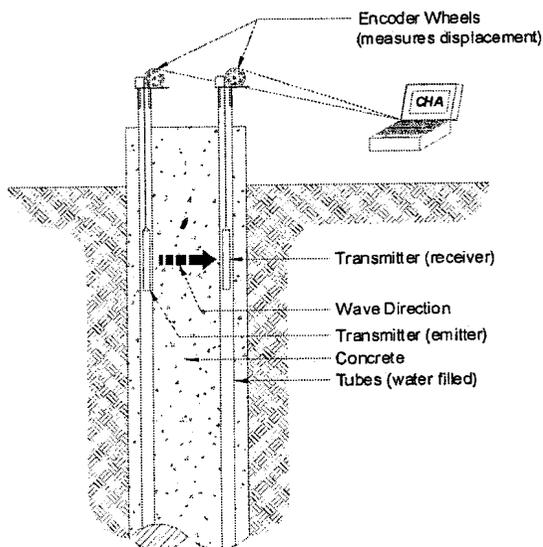


Figure 1 Typical cross-hole setup

vertical extent of each record is exactly the distance over which records are collected (approximately the length of tubes in the shaft). The waterfall diagram is an intuitively clear representation of concrete quality over depth. Normally the test is repeated for all perimeter tube pairs and also the major diagonals to investigate the concrete quality and homogeneity between the tubes.

The most important result from the CHA is the first arrival time (**FAT**) of the signal at the receiver, relative to the time the transmitter pulse has been generated. FAT can be determined visually from the waterfall diagram or it can be automatically determined. In the CHA, FAT is recognized when the signal in the receiver exceeds both some absolute threshold and a certain, user selectable, percentage of the maximum signal.

If the distance between the tubes is known, then a **Wave Speed** can be calculated from FAT and the tube spacing. The wave speed in the concrete can indirectly assess the concrete quality. This wave speed is subject to a variety of potential error sources and therefore should be used with caution when judging the quality of shaft concrete. For example, the wave speed is not only the wave speed in the concrete but it also depends on the wave speed in water and tube and, therefore, in the location of the sensor within the tube (tubes are typically twice as large as the sensor diameters). The greatest error source is however, the unknown distance between the tubes which can only be measured at the shaft top. Tube spacings often vary, particularly for the plastic PVC tubes. The CHA software allows for the plotting of either FAT or Wave Speed.

The signal strength is evaluated by digital integration over time of the absolute value of the signal. The duration of the signal integration is typically in the range of 10 to 20 samples (although for longer samples, the shape of the curve usually is similar). The result of this integration is called the signal **ENERGY**. There are no absolute values of energy that can be used for concrete quality assessment, however, a local relative reduction of "energy" by more than a factor of 10 usually indicates a serious relative reduction of concrete quality. For example, if energy is seriously lower at

a certain depth between two neighboring tubes on the shaft's periphery and not in the interior of the pile, then the concrete cover of the shaft has a reduced quality.

The CSL results may be evaluated for shaft integrity and concrete homogeneity. Shaft integrity may be identified by a consistent wave arrival travel time between access tubes. When the arrival signal is delayed, lower quality concrete due to mixing with drilling slurry, honeycombing, or soil inclusions may be present. Delayed signal arrival could also be the result of slow curing or poorer quality concrete. A complete loss of signal generally indicates significant defects in the concrete between access tubes such as caving of the surrounding soil, or a void in the shaft.

3. RESULT INTERPRETATION

Quantitative evaluations of shaft quality based on CSL measurements often involve judgment and experience. The following can be concluded from the CHA results.

The **vertical extent** of a concrete quality change is easily measured in the vertical display of FAT, wave speed, energy or waterfall diagram.

The **horizontal extent** of a defect or the percentage of cross sectional area affected has to be estimated from the various profiles showing the same defect. If the defect is located in only some tube profiles, offsetting the probes vertically and repeating the test may help locate the defect's horizontal position.

The **severity** of the change in concrete quality is generally judged from the relative change of FAT:

- Anomaly: FAT increase of less than 20% relative to average FAT
- Flaw: FAT increase between 20 and 30% relative to average FAT
- Defect: FAT increase greater than 30% relative to average FAT

The severity of the change in concrete quality also should involve an assessment of the relative energy, however, in a more qualitative rather than quantitative manner. Large reductions in energy (e.g. factor of 10 or more) generally are sure indications of major problems, though smaller reductions also may indicate problems.

4. DISCLAIMER

As with most Non-Destructive methods of pile material testing, results are not always a clear indication of the strength of a shaft. A variety of error sources or limitations can mask some of the defects (e.g. the quality of the concrete that is not in the path of the stress waves between tubes) while exaggerating others (a tube de-bonded from the surrounding concrete might yield a severely reduced signal strength.) It is therefore suggested that the CSL results are always used together with other records of shaft installation and that they are not used as the sole basis for shaft rejection or shaft acceptance. In general, the access tubes are attached to the inside of the reinforcing cage. The CSL tests only the concrete between the tubes and thus generally cannot evaluate the concrete cover for the cage. If a defect is not on a direct path between tubes, some controlled tests suggest that the defect would not be detected.

5. CORRECTIVE MEASURES

A limited number of corrective measures are available when a defect is indicated by the CSL method. Such measures include:

- Static load testing to prove the shaft integrity to be adequate. This is often the most expensive alternate and not well suited for testing large numbers of shafts.
- Dynamic Load Testing (DLT) with a Pile Driving Analyzer® which would yield evidence of satisfactory shaft performance under the dynamic load, which is typically in the range of the shaft's service loads.
- Sonic Pulse Echo testing with the Pile integrity Tester™ (PIT) as an additional method of non-

destructive testing. PIT, for example, could resolve whether or not a simple de-bonding or a more severe defect has caused a reduced Energy or increased FAT.

- Coring of the shaft; this is probably the most widely accepted additional inspection method. Besides yielding a concrete core, video cameras can be used in the cored hole for a visual inspection of the shaft concrete.
- Repair by grouting high strength reinforcement bars in the access tubes. This is only possible if the tubes are made of steel.
- Pressure grouting the shaft either by piercing the tubes or by cored access holes.



Cross-Hole Analyzer (CHA-QX) Specifications July 2008

Physical:

Size: 155 x 320 x 385 mm

Weight: 8 kg

Screen: High contrast VGA backlit transfective LCD display for all lighting conditions

Operating temperature range: 0 to 40 degrees C.

Power: 120-220 VAC (50-60HZ) to 12 VDC converter or 12V battery;

Internal backup battery for up to 30 min of operating time.

Built-in water resistant keyboard and mouse.

Electronic:

512MB DRAM

40 GB Hard Disk minimum

Serial, Parallel, Ethernet and USB ports

CD-RW Drive

Analog to digital converter resolution: 12 bits

Sampling rate: 500 KHz

Scan rate: 60 scans/second, allows pulling rate of up to 1.5 m/second

Measuring accuracy: 2 μ seconds

User adjustable trigger level, gain and transmission power

Other:

English/SI units

PC-compatible Pentium® (or equivalent) processor with Windows® operating system.

Furnished CHA-W software for data analysis

Includes technical manual

One year warranty included

Cross-Hole Analyzer Probes and Cable Specifications

Physical:

Transmitter: 185 mm length x 25 mm diameter

Receiver: 185 mm length x 25 mm diameter

Probes element: ceramic

Probes housing: brass

Cable material: heavy duty polyurethane outer jacket

Cable length: 60, 100 or 150 m

Electronic:

Transmitter frequency (nominal): 100 KHz

Receiver: tuned to 100 KHz nominal

Transmitter voltage: 200, 400, 600 or 800 Volts (user selectable)

Other:

Independent depth encoder for each probe

BARRON & ASSOCIATES, P.C.

10440 Main Street
Clarence, New York 14031

Tel: (716) 759-7821 www.barronandassociatespc.com Fax: (716) 759-7823

February 26, 2014

Buffalo Drilling Company, Inc.
10440 Main Street
Clarence, New York 14031

ATTN: Mr. Donald E. Bortle Jr.

RE: B&A Qualifications and Experience with
 Cross Hole Sonic Logging (CSL) Procedures

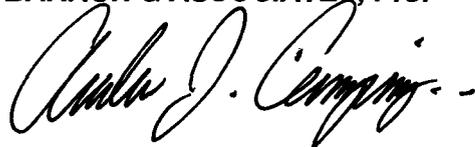
Gentlemen:

Barron and Associates, P.C. (B&A) professional staff of engineers and geologists have been involved in the concrete placement quality assurance of drilled shaft foundations via CSL methods for over 10 years. Our professionals have been trained in the methods and procedures of CSL data acquisition using Pile Dynamic, Inc's (PDI) Cross Hole Analyzer (CHA) and associated equipment and tooling. Our experiences includes multiple drilled shaft projects associated with deep foundations for roadway, pedestrian and railroad bridges in conjunction with the New York State Department of Transportation (NYSDOT) and other private entities. These projects have taken place all across New York State, including but not limited to Buffalo, Rochester, Owego and Poughkeepsie.

The analysis of the acquired field CSL data will be prepared by a third party engineering firm, GRL Engineers, Inc. of Cleveland, Ohio. GRL is world renowned for CSL and other non-destructive quality assurance and integrity testing techniques. Their publications, research and professional expertise have been integral in the main streaming of CSL procedures.

Thank you for the opportunity to provide continued assistance with this project. Please call with questions or if additional information is necessary.

Very truly yours,
BARRON & ASSOCIATES, P.C.



Andrew J. Camping
Sr. Geologist / Project Manager

Buffalo Drilling Company, Inc. (BDC) Concrete Core Retrieval - Revised

Summary: It is the intention of *BDC*, if needed, to mobilize to the site one of the drill rigs noted in Attachments 12b, 12c, 12d, or 12e and use it in conjunction with the NX core barrel depicted in Attachment 12f or use the Alternate Manual Coring Method outlined below under Item C for shallow (usually less than 20 feet deep) core investigations.

A) Drill Rigs

BDC will mobilize a drill rig to the site along with all required drill tools, water tank, pump, and core boxes for storage and transport of retrieved concrete cores. One of the four drill rigs noted will be used for coring operations. *Kubricky Construction Corp. (KCC)* will provide access to the caisson for *BDC*'s coring, through the construction of ramps, pads, and/or the moving of dowels that may pose as obstructions.

B) Coring the Concrete

BDC will then core the concrete using the NX core barrel and/or the directions of the engineer. Cores will be labeled for depth, caisson number, core location, and core number, placed into a wooden core box, and given to *KCC* for delivery to the EIC.

C) Alternate Manual Coring Method

To perform form core retrieval at shallower depths, less than 10 feet in depth, *BDC* may core the concrete using our manual core drill made up of the following components.

- 1) The Coring Stand on the bottom right of the first page of submittal section 12g (labeled 116) consists of the M-2 Roller Carriage Upgrade and Anchor Stand parts 424110 and 427753
- 2) The Coring Machine Drill Motor, on the second page of 12g (labeled 130) is a WEKA DK32 powered by 230 volts whose part number is 4244058.
- 3) The third page of 15g (labeled 117) displays the two components working together as a core drilling unit.
- 4) The coring machine will be turning the 2" Core System, depicted in submittal Section 12h, to retrieve a core with an approximate diameter of a bit less than 2.00 inches at the locations and to the depths specified by the EIC.

In all instances cores will be labeled for depth, caisson number, core location, and core number, placed into a wooden core box, and given to *KCC* for delivery to the EIC.

1978 Bmbadier Mobile B34-S
Tracks: Rubber with metal cleats
Serial # 624416
Fuel: Diesel

Unit 208

Total height of machine boomed up 22 foot 10 inches/ boomed down 10 foot
Total width of track 7 foot 3 inches/ total width of machine 7 foot 9 inches
Over all length of machine 18 foot

Unit - 209

1972 CME 550/ Atv Rig
Model: Gemco WF240P
Serial # 604
Tire Size: 23 ft./ front 26 ft. rear
Fuel: Diesel

Total height of machine boomed up 27 foot 5 inches/ boomed down 10 foot 7 inches
Total width of machine 8 foot 2 inches
Over all length of machine 22 foot/ length of machine from center of axeles 12 foot 4 inches

1984 Dietric D-50
Engine: Hercules 4 cyl
Vin # 322770040
Track/Make: Bombarier,
Rubber with metal cleat
fuel: Gas

Unit -213

Total Height boomed up 27 feet 4 inches/ boomed down 9 foot 6 inches
Width of entire machine 7 foot 2 inches.
Over all length of machine boomed down and tabled in 23 feet

1975 CME 75/ ATV Rig

Engine: Deutz 750XL

Serial # F6L912

Vin # 105358

Fuel: Diesel

Unit- 222

Total height boomed up 30 foot 6 inches/ boomed down 6 feet 6 inches

Width of entire machine 8 foot 2 inches

Over all length of machine boomed down 23 feet 8 inches/ wheel base center of axle to center of axle 12 feet 6 in.

CORE DRILLING TOOLS



Diamond drill bits and tools

An excellent assortment of diamond tools for the exploration and construction industries, including surface set and impregnated bits, reaming shells and casing shoes suitable for most drilling conditions.

Drill rods and casing

A production of wireline drill rod and casing.

Core barrels

Core barrel systems for vertical down to -45° angle holes, as well as pump-in systems for uphole drilling. Both supported by retrieval overshot devices.

Sizes / Systems

System	Hole		Core	
	mm	in	mm	in
A	48,0	1.89	27,0	1.06
B	59,9	2.36	36,4	1.43
N	75,7	2.98	47,6	1.88
H	96,1	3.78	63,5	2.50
P	122,6	4.83	85,0	3.35

- Wireline system which affected the rod and core barrel design and incorporated the use of a wireline overshot.
- Triple-tube system which effected the core barrel and the bit design and allowed for a second split inner tube to be used so that an undisturbed sample of very broken core could be viewed in its original state.
- Thin kerf or light weight systems which effected the design and dimensions of the entire drill string to allow for a larger core sample to be retrieved at increased depths or in similar sized hole.

M-2 HEAVY DUTY CORE RIGS

 Electric

 Hydraulic

10"
(up to 36" with
spacer & hydraulic motor)
Bit Capacity

Features:

- Dual switch/outlet control panel with amp meter (except for CB700 models with LED amp meter)
- 4-spoke handle
- 2-7/8" precision made, chrome plated square column (mast)
- Vacuum pump for quick mounting to flat surface without drilling an anchor hole (Included with combination rig)
- 10" bit capacity (up to 36" with spacer block or pillow block and hydraulic motor)
- 6" wheels for easy mobility
- 4 Leveling Screws on base

The #1 Pro Rig in the U.S.A.

Benefits:

- Heavy duty rig for larger jobs
- Larger mast to withstand high torque and large diameter bits
- The 4-spoke handle allows the operator to easily apply feed pressure
- Great for the professional driller
- Roller carriage available for more precise drilling, which in turn promotes longer life on diamonds
- Combo base is a quick change over from vacuum to anchor base



M-2 Complete Combo Rig with CB748 motor

*Spacer blocks are found on page 142



M-2 Complete Anchor Rig with Weka motor

Parts List: #1801636
Operator Manual: #1801993



Improved Vacuum Seal Retention Keeps Vacuum Gasket Held Into the Base Longer for a Durable Seal



CORING EQUIPMENT

Angle Combination Stand Only			Combination Stand Only			Large Base Anchor Stand Only			Angle Anchor Stand Only			Anchor Stand Only		
Part #	Cat #	List Price	Part #	Cat #	List Price	Part #	Cat #	List Price	Part #	Cat #	List Price	Part #	Cat #	List Price
4241056	01702	\$ 1,603	4241055	01700	\$1,258	4241064	01708	\$1,258	4241110	01717	\$1,448	4241100	01714	\$ 1,108

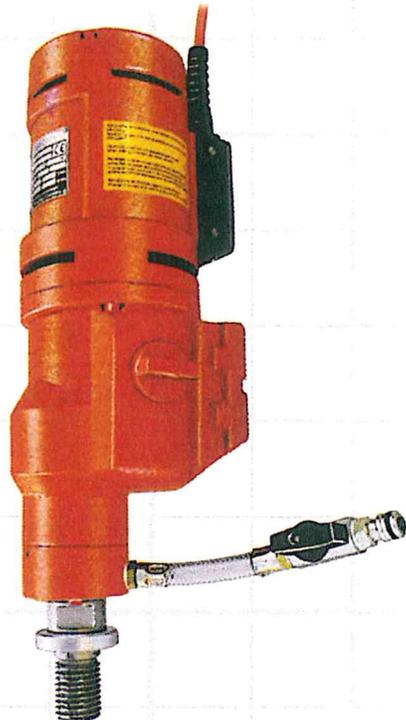
Upgrade your slide carriage to a heavy duty roller carriage. Lasts longer and gives precision movement. Order with new rigs or for existing rigs.

M-2 Roller Carriage Upgrade (With New Rig)			M-2 Roller Carriage Upgrade (Existing Rigs)		
Part #	Cat #	List Price	Part #	Cat #	List Price
4241000	01684	\$ 234	4277531	01844	\$ 901



DK22

- Heavy duty
- Water connection
- 1.250"-7 threaded spindle
- Recommended for bits up 1"-12" Max 16"



DK32

- Heavy duty
- Water connection
- 1.250"-7 threaded spindle
- Recommended for bits 2"-16" Max 18"

WEKA ELECTRIC DRILL MOTORS

Motor/Model #	AMP	No Load RPM	Loaded RPM	Part #	Cat #	Product Weight (lbs.)	List Price
WEKA DK22	23 (110V)	550/1120/1680	300/640/960	4244018	01741	31	\$2,926
WEKA DK22	11 (230V)	550/1120/1680	300/640/960	4244016	47069	31	2,926
WEKA DK22L	23 (110V)	460/940/1400	250/520/780	4244105	54872	31	3,355
WEKA DK22S	23 (110V)	800/1640/2430	420/880/1300	4244014	47828	31	2,926
WEKA DK22S	11 (230V)	800/1640/2430	420/880/1300	4244029	47070	31	2,926
WEKA DK22F*	23 (110V)	550/1120/1680	300/640/960	4244118	40586	31	2,732
WEKA DK22F*	11 (230V)	550/1120/1680	300/640/960	4244119	53300	31	2,732
WEKA DK32	30 (110V)	380/800/1200	230/480/720	4244059	46896	31	3,152
WEKA DK32	15 (230V)	380/800/1200	230/480/720	4244058	47071	31	3,152
WEKA DK32F*	30 (110V)	380/800/1200	230/480/720	4244120	56143	31	2,953
WEKA DK32F*	15 (230V)	380/800/1200	230/480/720	4244121	44292	31	2,953

All Weka motors include on/off switch

*F series include special flange adapter for M-5 PRO only (11" maximum bit capacity)

CORING EQUIPMENT

COMPLETE M-2 COMBINATION DRILL RIGS WITH VACUUM PUMP

Model #	Motor	Motor RPM	Part #	Cat #	Product Weight (lbs.)	List Price
M2C-20-CB-V	20 Amp Core Bore CB748	350/900	4241050	01696	135	\$3,629
M2C-20-CB700-V	20 Amp Core Bore CB700	400/930	4241164	30117	135	2,990
M2C-20-MW4004-V	20 Amp Milwaukee	300/600	4241048	01694	139	3,385
M2C-20-MW4096-V	20 Amp Milwaukee	450/900	4241059	01704	139	3,385
M2C-20-MW4005-V	20 Amp Milwaukee	600/1200	4241049	01695	139	3,385
M2C-15-MW4097-V	15 Amp Milwaukee	500/1000	4241051	59573	139	3,313
M2C-23-DK22-V	23 Amp Weka DK22	550/1120/1680	4241068	47426	137	4,601
M2C-23-DK22S-V	23 Amp Weka DK22S	800/1640/2430	4241069	50007	137	4,601

COMPLETE M-2 COMBINATION DRILL RIGS WITHOUT VACUUM PUMP

M2C-20-CB	20 Amp Core Bore CB748	350/900	4241082	71149	122	\$3,268
M2C-20-CB700	20 Amp Core Bore CB700	400/930	4241166	30152	122	2,327
M2C-20-MW4004	20 Amp Milwaukee	300/600	4241083	76314	124	3,035
M2C-20-MW4096	20 Amp Milwaukee	450/900	4241084	75479	124	3,035
M2C-20-MW4005	20 Amp Milwaukee	600/1200	4241085	69558	124	3,035
M2C-15-MW4097	15 Amp Milwaukee	500/1000	4241086	76984	124	2,962
M2C-23-DK22	23 Amp Weka DK22	550/1120/1680	4241088	73291	120	4,254
M2C-23-DK22S	23 Amp Weka DK22S	800/1640/2430	4241089	75275	120	4,254

COMPLETE M-2 ANCHOR DRILL RIGS

M2A-20-CB	20 Amp Core Bore CB748	350/900	4241001	01686	110	\$3,113
M2A-20-CB700	20 Amp Core Bore CB700	400/930	4241163	30098	110	2,201
M2A-20-MW4004	20 Amp Milwaukee	300/600	4241009	01692	114	2,884
M2A-20-MW4096	20 Amp Milwaukee	450/900	4241003	01687	114	2,884
M2A-20-MW4005	20 Amp Milwaukee	600/1200	4241010	01693	114	2,884
M2A-15-MW4097	15 Amp Milwaukee	500/1000	4241006	01689	114	2,812
M2A-23-DK22	23 Amp Weka DK22	550/1120/1680	4241008	01691	114	4,103
M2A-23-DK22S	23 Amp Weka DK22S	800/1640/2430	4241011	52247	114	4,103

CB700 Rigs do not include a control panel. - CB700 has a built-in amp meter.

Over a Thousand Different Ways to Build Your Custom Rig!

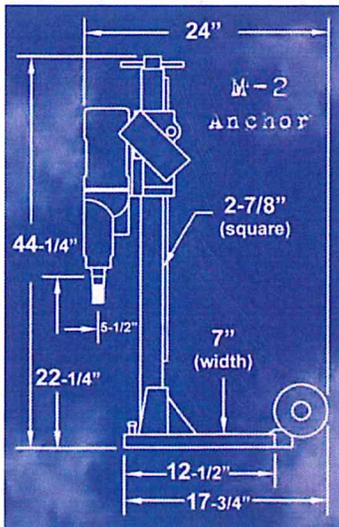
Drill Stand Only includes: base, column (mast), carriage, ceiling jack, motor mount plate and wheels

Complete Combination Rig includes: combo anchor/vacuum base, drill motor, column (mast), motor mount, carriage, control panel, vacuum pump

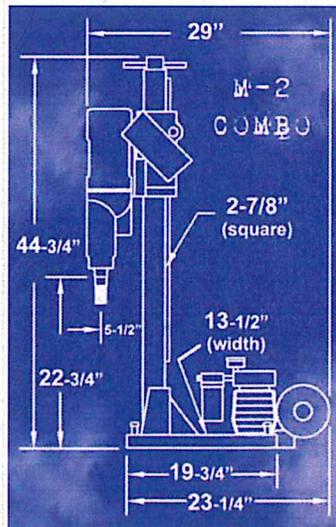
Complete Anchor Rig includes: small anchor base, drill motor, column (mast), carriage, control panel, ceiling jack and wheel kit

Custom Combination Rig Components:
 Combo drill stand, Drill motor (pages 129-131), optional control panel (page 140) and optional vacuum pump (page 140)

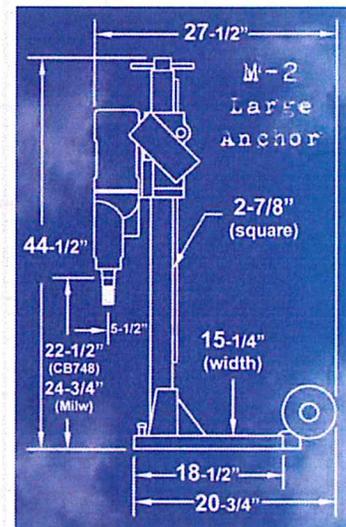
Custom Anchor Rig Components:
 Anchor drill stand, drill motor (pages 129-131) and optional control panel (page 140)



Location to drill anchor hole = 12" Measured from the center of the motor spindle to the center of the anchor slot on base



Location to drill anchor hole = 12" Measured from the center of the motor spindle to the center of the anchor/vacuum slot on base



Location to drill anchor hole = 12-1/2" Measured from the center of the motor spindle to the center of the anchor slot on base



Don't forget to ask about our 3 Year Gold Extended Warranty on new electric core rigs!

Don't forget to ask about our 5 Year Platinum Extended Warranty on new electric core rigs!



HOFFMAN DIAMOND PRODUCTS, INC.

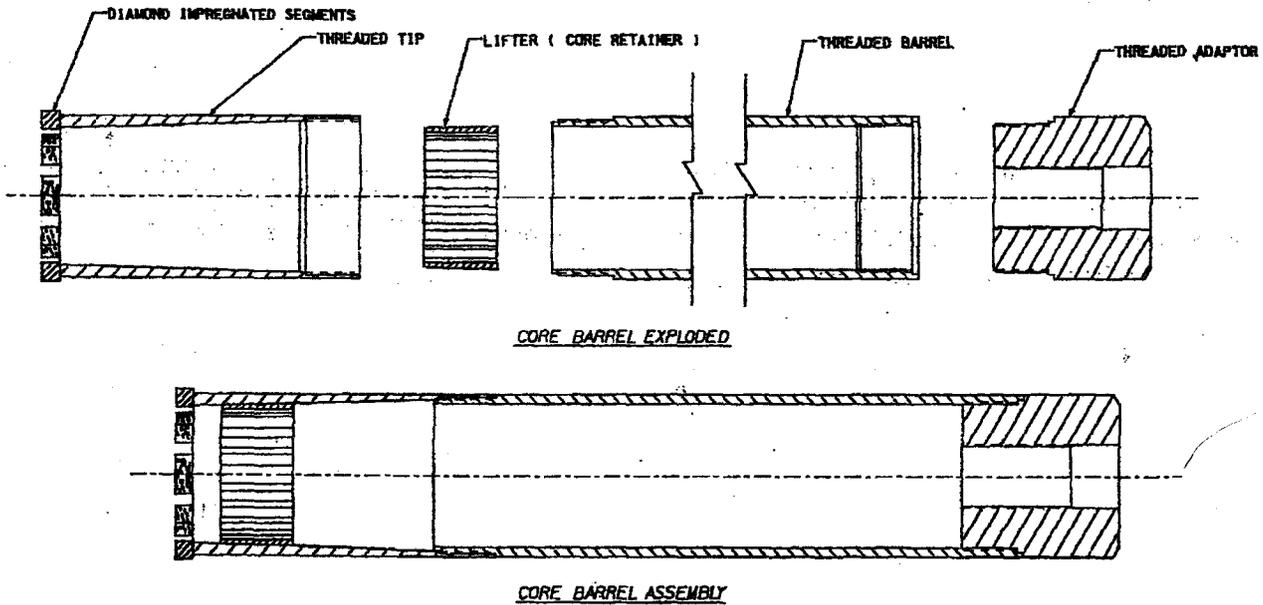


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CORE CATCHER SYSTEM

Use the right tool for the job.

Have you ever had trouble recovering a deep core? Ever had a core fall from a bridge deck or a second story? These things are not only a nuisance but they can be dangerous. Now a simple tool can eliminate these problems. It's the Hoffman Core Catcher. The Hoffman Core Catcher consists of a treaded bit tip, core barrel, threaded adapter, and a core catcher. When you raise the core barrel, the core inside comes along. If the job demands core recovery or safety from falling core, purchase the Core Catcher System from Hoffman Diamond Products.



Size (OD X ID)	Pro 800 Bit	Pro 1000 Bit	1 ft. long Barrel	2 ft. long Barrel	3 ft. long Barrel	4 ft. long Barrel	Core Catcher	1-1/4" Adaptor
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2" (2.437 X 2.000)	240	318	142	187	231	278	63	92
3" (3.437 X 2.875)	319	448	171	230	291	353	71	119
4" (4.437 X 3.992)	415	567	196	271	347	423	72	174

Size	Bit OD	Bit ID	Impregnated Bit	Blank Shell	1 ft. Barrel	2 ft. Barrel	5 ft. Barrel	Core Catcher	NW Conn. Adaptor or 1-1/4-7
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6"	6.062	5.312	1000	240	360	400	535	247	415
8"	8.2	7.375	1167	309		533		367	500